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CITY COUNTY STATE

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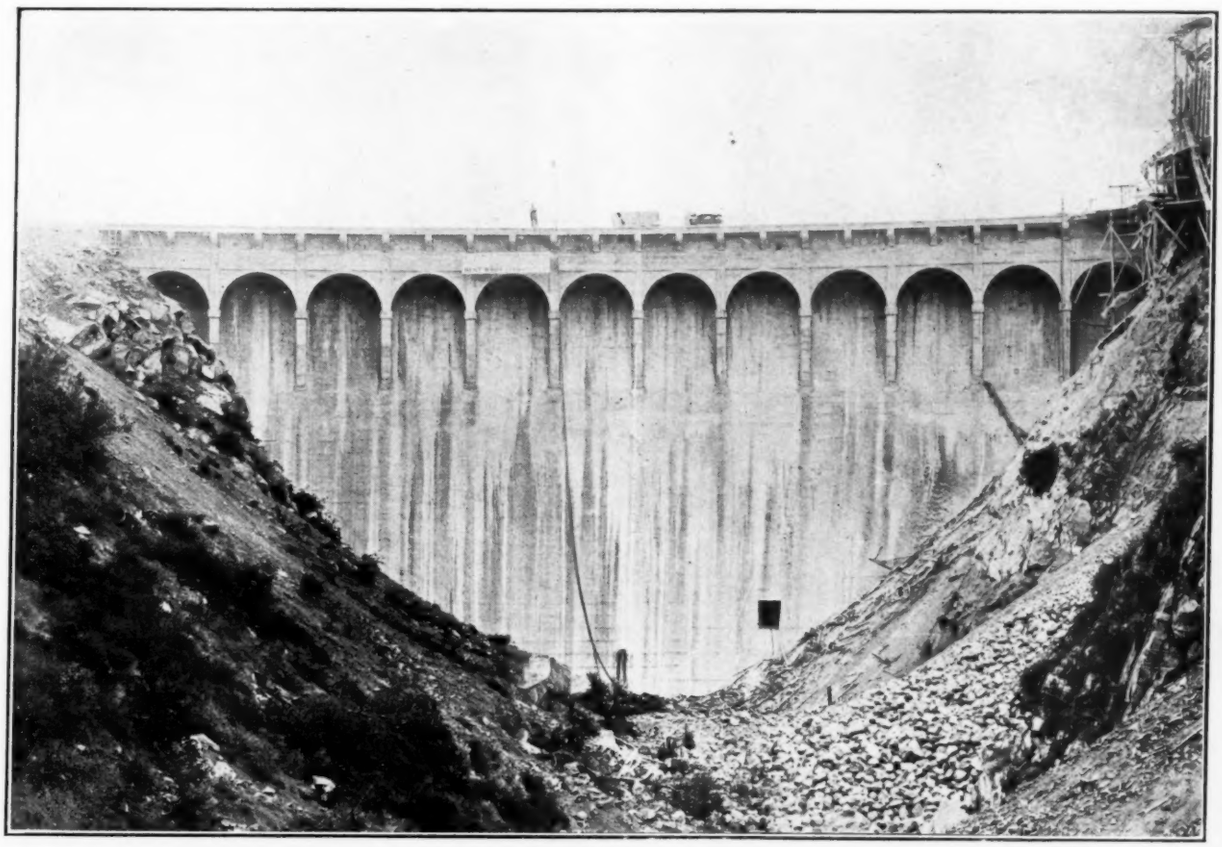
"MUNICIPAL JOURNAL AND PUBLIC WORKS" and "CONTRACTING"



DEVIL'S GATE DAM ON ARROYO SECO, SOUTHERN CALIFORNIA
(Description of this dam will be given in next week's issue

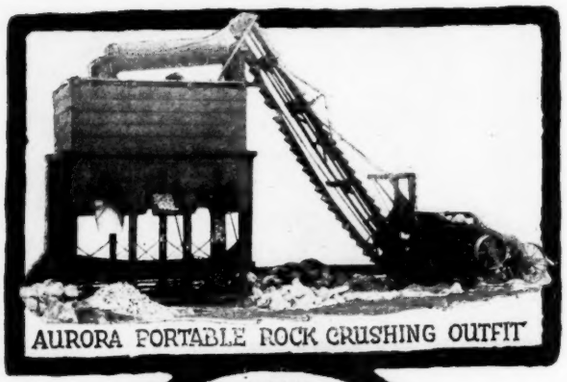
IN THIS ISSUE

Building a New Jersey State Highway of Concrete
Effect of Storage on Cement
Machinery in Alley Paving
Operation of Sewage Treatment Plants
Constructing Water Supply Works of Winnipeg
The Waterworks of Deland
Concreting Plant and Operation

JULY 31, 1920

THE AUSTIN-WESTERN ROAD MACHINERY CO.

This Complete Line



AURORA PORTABLE ROCK CRUSHING OUTFIT

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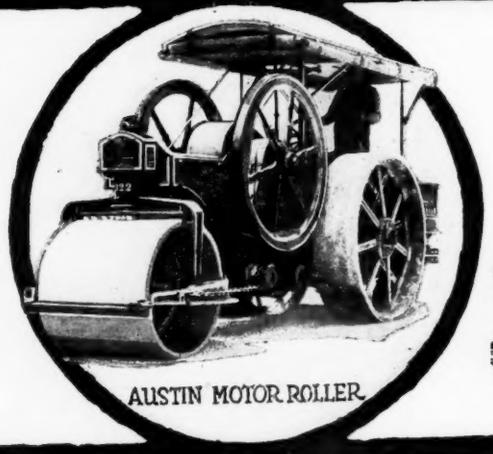
Steam Rollers	Road Graders
Scarifiers	Elevating Graders
Rock Crushers	Dump Wagons
Stone Screens	Street Sprinklers
Stone Elevators	Street Sweepers
Portable Bins	Motor Sweepers
Quarry Cars	Road Plows
Stone Spreaders	Wheeled Scrapers
Drag Scrapers	

In this, the complete Austin-Western line, is to be found everything a contractor or a municipality may need for the building of roads or streets—from crushing the rock to sweeping a finished pavement.

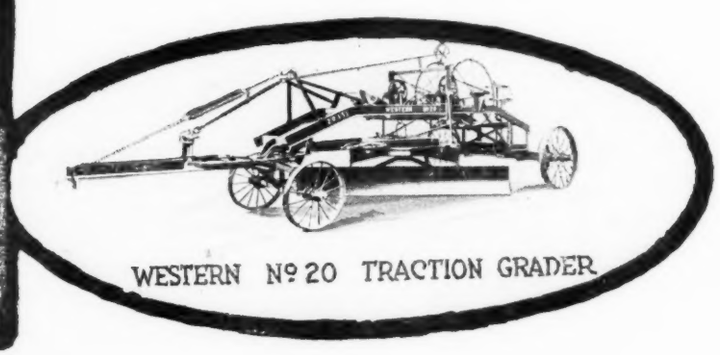
Back of this extensive line is an efficient service organization with branch offices advantageously placed at logical distribution points—as shown by our list of branch offices at bottom of this page.

We picture four members of the Austin-Western line. We would like to illustrate and describe all our products. Permit us to do so by means of our special catalogs and specific information about those particular machines you may be most interested in.



AUSTIN MOTOR ROLLER

AUSTIN ROAD OILER WITH HEATER ATTACHMENT



WESTERN No. 20 TRACTION GRADER

THE AUSTIN-WESTERN ROAD MACHINERY CO.

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A Combination of "MUNICIPAL JOURNAL AND PUBLIC WORKS" and "CONTRACTING"

Vol. 49 FLORAL PARK, JULY 31, 1920 No. 5

Constructing Water Supply Works of Winnipeg*

By W. G. Chace, Chief Engineer, Greater Winnipeg Water District

Important Construction Features; Service Railroad, Diversion Dyke, Uniform Aggregate Supply, Contractors Camps, Excavating and Handling Earth, Preparation of Foundations, Concreting Invert and Arch, Manufacturing Large Pipes, Surge Tank, Tunnel and Shaft Work, Trouble from Alkali Soil.

***During the season of 1914 there were undertaken and completed the following works preparatory to the construction of the Winnipeg aqueduct: An earth filled dyke one and one-half miles long built in about fourteen feet of water for the purpose of excluding from the intake water the discharge of the swamp-fed Falcon River, whose color was very dark; a standard gauge railway with one hundred and two miles of trackage upon the right of way chosen for the aqueduct; and a telephone line of No. 14 copper wire on wooden poles.

FALCON DYKE

The Falcon River Dyke is a structure designed purely as a guiding wall to divert the flow of the Falcon River across the westerly end of Indian Bay into an adjoining body of water, Snowshoe Bay, through a canal across the neck of land separating these two bays. The material for it was obtained from a suitable deposit of sand located a few hundred feet north of the north end of the dyke. It was excavated with steam shovel and delivered by means of dinky and four-yard cars into place.

The building of a trestle was avoided by the use of a scow held out from the advancing end of the dyke with heavy stringer timbers upon which the railway track was extended; the full cars were backed up over these stringers, were dumped at the end of the dyke and the empties were run out on to the scow until the train had been discharged. This method was continued until the southerly shore was reached when the scow was removed and a slight trestle of short length permitted the closure of the dyke against the shore. The easterly exposed face of the dyke was heavily riprapped with rock from a borrow pit located at the north end of the structure. * * *

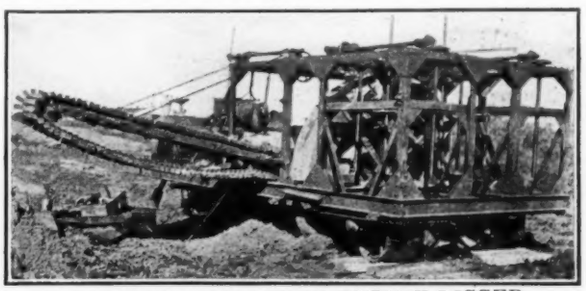
RAILWAY

No great difficulty attended the construction of a railway although most of the route was swamp covered and surface drainage was a first essential, the country being so flat. The grade was built up from side borrow entirely and for several miles this borrow consisted of nothing more solid than peat particularly on the summit of land separating Lake of the Woods from the Lake Winnipeg drainage. Gravel pits were found at convenient intervals and the work of ballasting was about eighty per cent completed at the close of the season.

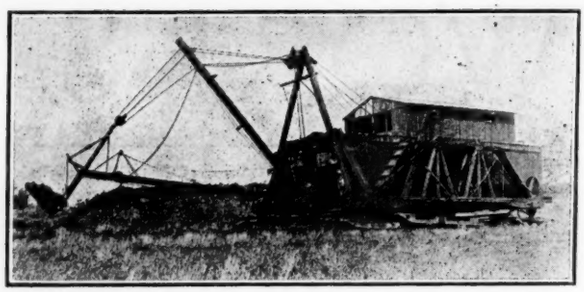
The construction of this railway was *sine-qua-non* of the successful building of the aqueduct. The country traversed was virgin land between miles 40 and 96, and nearly altogether swamp covered. No highways were available for the transport of material for construction nor could any be built cheaply; railway transport was recognized immediately as the key to rapid construction of the aqueduct. * * *

*Excerpt of a paper presented to the American Water Works Association in Convention at Montreal, June 2?, 1920. Accompanying paper by James H. Fuertes, consulting engineer and designer, which was published in July 3, et. seq.

BACKFILLING WITH DRAGLINE



EXCAVATING WITH ROTARY DIGGER



WALKING DREDGE EXCAVATING TRENCH

The right of way chosen was generally three hundred feet in width from the reservoir site near Transcona at Mile 13 to Mile 74; thence to Mile 84, the Birch River forms one boundary; and thence eastward to the intake the general width chosen was 500 feet, chiefly because the maximum depth of cut necessary for the crossing of the height of land was in the neighborhood of 23 feet and the material to be excavated consisting of 7 feet of peat, 10-15 feet of sand and sandy clay to a waxy clay floor. That the accomodation afforded by so wide a right of way was warranted by the experience of construction, for numerous slides occurred, spoil from which had to be thrown in places over 150 feet away from the trench.

DISTRICT SUPPLIED CONCRETE AGGREGATE

For purposes of rapidity in construction it was early determined that the work should be let in sections of moderate lengths; this policy also encouraged the engagement of local contracting organizations but it involved that the Water District itself should operate the system of transport and should excavate and supply the sand, gravel and crushed stone for the manufacture of concrete. Gravel pits were not to be found of a satisfactory quality convenient to each eighteen or twenty mile stretch of the structure; and confusion would have been the result from any effort toward the sub-division of the responsibility either for the supply of material or for the transport of plant and material.

The Water District therefore selected after test two satisfactory sources of sand and gravel supply and throughout the major portion of the time of construction the District supplied a mixture of sand and gravel concrete aggregate upon platforms opposite the contractors' working points. The policy of supplying mixed material not only minimized the quantity of rolling stock necessary for the work but also permitted assurance of the use of a uniform material throughout the entire mileage of the aqueduct. The difficulties of inspection of concrete making and mixing were also greatly diminished thereby and the cost to the contractors for the manufacture of concrete was necessarily less than would have been the case had sand and gravel or crushed stone been supplied separately.

TESTS

In determining the quality of this uniform concrete aggregate a series of laboratory tests were carried out during the winter of 1914-15 in an effort to determine the mixture of Portland cement and of aggregate for the production of a concrete which would be water tight, sufficiently strong in compression and at the same time not wasteful of cement. These experiments were carried on with mixtures containing only one barrel of Portland cement per cubic yard.

It was ultimately determined that by the use of a proper proportion of dust or fine sand in a fairly graded sand a 6-inch wall of concrete could be made impervious to water under pressure of 80 pounds per square inch, the test adopted. (Recently investigators have been able to make 1-inch slabs impervious against similar pressure and by similar means). This subject was discussed in a paper read by the writer and Mr. D. L. McLean before the Engineering Institute of Canada in 1916.

The Water District, having determined upon the policy of supplying the sand and gravel to the contractors, determined also to supply the necessary Portland cement under purchase contracts and thereby to ensure a uniform cement for the entire project. Such a supply was obtained in Winnipeg from the mills of the Canada Cement Company and by virtue of the local sources being available the supply was kept steady and deliveries were prompt as required; storage of cement by the District was thus avoided.

TRAFFIC ON SERVICE RAILWAY

The total traffic over the District railway during the period of construction was fairly heavy, carloads of aggregate contained 23 cubic yards each or a total weight of 130,000 pounds per unit; the rate of consumption of concrete materials ran as high as 1,200 cubic yards per day and the principal source of supply was located at Mile 31.

Throughout the entire construction approxi-

DRAGLINE USED FOR ROUGH-TRIMMING TRENCH

BACKFILLING OVER COMPLETED CONDIT

mately 1,000,000 cubic yards of sand and gravel were moved for concrete manufacture; for the building up of trench foundation where firm soil was at too low an elevation; and for backfill where native and local materials were scarce. This traffic was in addition to the haulage of Portland cement — about 600,000 barrels — the distribution of contractor's plant and reinforcing steel for the transport of passengers. A tri-weekly mixed train served to distribute plant, cement and steel, and meet the requirements of passenger movement; aditional trains handled the sand and gravel.

INTAKE

The site chosen for the intake is a rock cut on the Peninsula which forms the north end of the Falcon dyke. Gathering walls of rock fill over a sand core extended about 200 feet into the lake to permit the draught of water from a sufficient depth. A concrete chamber located in the rock cut, houses the trash racks, the screens, the sluice gates and stop logs which provide the control of water discharged into the aqueduct; this building was covered with earth to lines coinciding with the profile of the peninsula.

During construction, a cofferdam of sand across the opening between the gathering walls provided the shelter for the rock excavations. This type of cofferdam, easily protected, easily maintained and easily removed, was quite satisfactory. * * *

CONTRACTORS' CAMPS

Speaking generally each contractor endeavored to keep his work concentrated at each camp and, excepting for backfilling operations, the excavation, trench trimmings and aqueduct building were confined within a distance of one-half mile in each case. The number of camps per contract varied from two to five depending upon the possible rates of construction; the total number of camps during the successive years were: 1915, eleven camps; 1916, fourteen camps; 1917, twenty camps; 1918, twenty-two camps; besides those operated at the District's sources of material supply, three in number. The maximum number of men engaged upon the project was about 2,500.

EARTH HANDLING

The methods of handling earth varied considerably; on the easterly 47 miles, Bucyrus draglines of from ⅝ to 3½ cubic yards capacity

PLACING FOUNDATION FILL

were used for excavating and for backfilling. These draglines were especially designed to be self propelling and were supported upon the swamp surface by means of timber pads built in sections, the machine itself being mounted upon rollers.

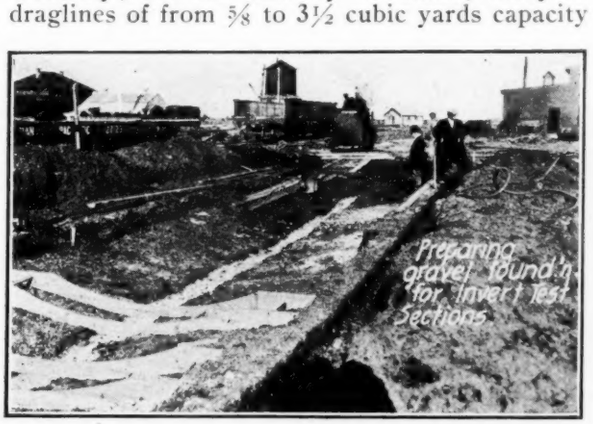
Between Miles 31 and 51 a few steam shovels were used with greater or less success; these were supplemented by means of draglines. Between Miles 13 and 31 walking dredges were used; here the cut was generally shallow and the soil fairly firm. Each type of machine had its advantages but speaking generally the dragline seemed the most suitable device.

Throughout the easterly 47 miles the spoil of excavation was dumped close to the trench and was formed into an elevated grade for a dinky railway track used to distribute the mixed concrete; earth so placed was convenient for backfilling but was occasionally the cause of slips of the trench wall, in which event the tramway grade was maintained by means of pole trestles.

Payment for the work of excavation was limited to fixed slopes of the trench walls namely one horizontal on three vertical in firm soil, and one horizontal on one vertical in soil which would not stand on steep slopes. Machine excavation was permitted to within 6 inches of the determined floor grade, and it was required that the remainder of the earth should be removed by hand.

DRAINING AND PUMPING

As all of the trench grade lay below the ground water level the problem of handling ground water



PREPARING GRAVEL FOUNDATION FOR INVERT TEST SECTIONS

TRENCH TRIMMING FOR PIONEER PADS

seepage and trench floor seepage was constantly a prominent one. Notwithstanding this fact it was possible to obtain compliance with the requirements of the specifications that all concrete must be laid in the dry.

This was accomplished by means of a system of side wall trench drains and of a center line depressed drain lined with a wooden box with transverse cover slats and surrounded with coarse gravel or broken stone. Diaphragm pumps operated by gasoline were successful in maintaining the ground water below the grade of the trench floor. Trimming of the surface of the earth for the reception of concrete was not permitted until the hour of concrete placing, and by observance of this rule the preservation of a firm surface for the receipt of concrete was assured.

(To be Continued)

Higher Water Pressure for St. Paul

In order to increase the water pressure in the down-town section of St. Paul, J. W. Kelsey, superintendent of the water department, has prepared plans for a new 6,000,000-gallon reservoir to be built adjacent to the McCarron pumping station and carried about 50 feet higher than the present reservoir. This was the result of a petition from the business men for greater pressure, they stating that at present water cannot rise higher than the third floor of some of the buildings.

The Water Works of De Land, Florida

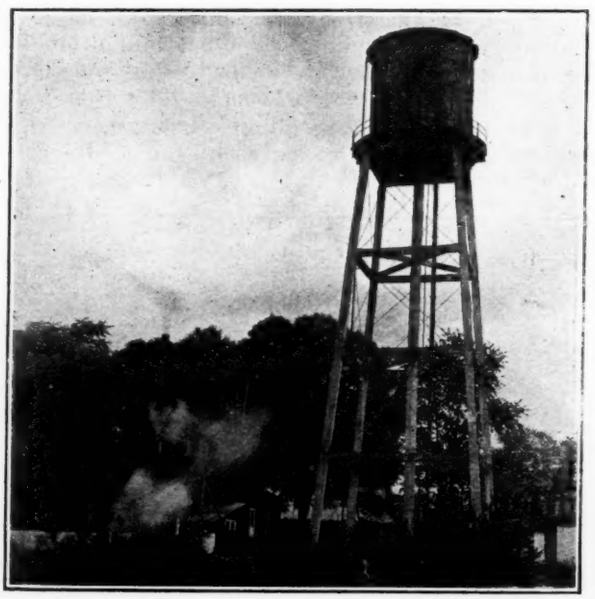
Chief among the advantages which the citizens of De Land, Fla., claim for their city is a supply of artesian water unlimited in quantity and of exceptional purity. As to the quality, the Board of Awards of the St. Louis World's Fair gave a medal to the water from the sister town of Orange City, as the world's finest water, and De Land's water has the same origin. The state chemist has made the following analyses of the De Land water.

Color	none
Sediment	none
Turbidity	none
Odor, cold	none
Odor, hot	none
Reaction to litmus paper	slightly alkaline
Total solids by evaporation	170.00 p. p. m.
Loss on ignition	1.940 p. p. m.
Fixed residue	168.060
Free ammonia	.006
Albuminoid ammonia	.042
Chlorine	11.120
Nitrogen as nitrates	.080
Nitrates	none

The water works are in charge of city engineer George Hill, who has been identified with every engineering project in and near De Land. He operated the first locomotive over a short road between De Land and the St. Johns river, later was chief mechanical engineer of the largest saw and planing mill in this section of the state, and has been in charge of the water works since 1909.

GROUNDS OF DE LAND WATER WORKS

The water works was installed in 1890, its first equipment consisting of a 30 horsepower boiler, a small pump, stand pipe and one of the present wells. The population then was slightly under 1500. Today the population is over 5000 and the equipment comprises a 50 horsepower Ames boiler, a 30 horsepower Casey and Hedges boiler, one 10-inch well 270 feet deep and one 6-inch well 400 feet deep, each operated by a duplex steam pump, and a standpipe of 47,000 gallons capacity on a reinforced concrete trestle 100 feet high. The plant has a capacity of 2¼ million gallons per day. Wood is the principal fuel used under the boilers and a reserve stock ample for 30 days is always held in reserve. There are about 1000 taps in service and about 43 applications for buildings under construction. Ninety-five per cent of the water used passes



DE LAND PUMPING STATION AND TANK

through meters. There are 65 hydrants for fire protection and street use and 26 miles of mains from 10 inches in diameter down.

The minimum rate is $4 per quarter, with an excess rate of 15 cents per thousand gallons for all over 10,000 gallons; the only exception from this being a flat rate of 15 cents per thousand gallons for florists and truck gardeners. During the past three years, the cost of operation has averaged $6,500 annually, while during the same period the gross income has averaged about $12,000, leaving a net income of $5,500. Surrounding the plant is a small park where abundance of flowers and semi-tropical shrubbery and careful attention to the neatness of the entire property make it an attractive spot.

Building a N. J. State Highway of Concrete

Four and one-half miles of 18-foot concrete highway at Pompton Plains well equipped with sand, gravel and stone producing facilities and well selected construction plant insuring first-class results.

Section 1 of route 8 of the New Jersey Highway Department consists of about 4½ miles of concrete roadway 18 feet wide, 6 inches thick at the edges and 8½ inches thick at the crown, and having on each side a shoulder surfaced with 3-inches of bituminous macadam 3 feet wide, adjacent to which is a French drain 8 inches wide on top with an open-joint pipe laid in the bottom and covered with broken stone.

The road has a nearly straight alignment with maximum grades of 1 per cent and is located on the line of an old macadam road 24 feet wide. The new grade varies somewhat from the old, being in most cases above the latter, and requiring about 1,000 yards of excavation and 9,000 yards of fill derived from the contract excavation and from the sand pit.

The construction involves about 20,000 linear feet of French drain, 3,000 feet of 12, 15 and 18-inch agricultural tile drain-pipe, four drainage ditches with an aggregate length of 3,500 feet, 2,000 linear feet of wood hand rail, 100 linear feet of pipe rail, 5 brick manholes, and about 12,000 cubic yards of 1:2:3 concrete foundation made with Penn Allen cement and ¾-inch and 1½-inch trap-rock, and 16,000 spuare yards of 6-inch asphaltic macadam surface The contract was awarded, on a unit cost basis, to the firm of Harrop & Shannon for about $200,000.

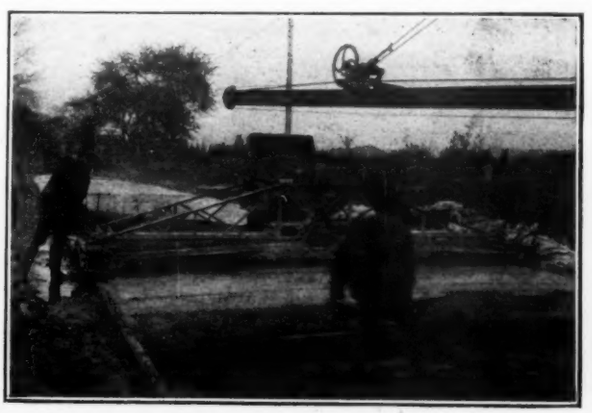
SAND PIT

The road passes through the village of Pompton Plains, which is about midway between the extremities of this contract section. The contractor's headquarters are established there in charge of James R. Donnelly. A few hundred feet from his office, the contractor has opened a sand and gravel pit where a ½-yard Keystone shovel has stripped off the loam from a 300 x 500-foot area to a depth of from 5 to 8 feet, and another shovel of the same make and size is digging, for the screening plant, sand and gravel from a cut about 25 feet wide and 10 feet deep that extends across the full length of the sand pit.

The sand excavation shovel delivers to three 1-yard side-dump cars hauled over 24-inch gage industrial track and dumped into the depressed hopper of a bucket elevator, which raises the materials about 30-feet to the set of three cylinder screens. These discharge into overhead storage bins of about 150 yards capacity which are divided into three compartments for sand, coarse gravel and fine gravel respectivly.

The horizontal floor of the bin is pierced with three holes commanded by sliding steel gates 10 feet above the roadway, by levers that provide for the discharge of sand and gravel into 5-yard automobile trucks spotted on the service road under the bin. The screening and elevating plant

AGGREGATE AND CEMENT STORED ON SUB GRADE



TAMPING MACHINE FINISHING ROAD SURFACE

STEAM SHOVEL EXCAVATING IN SAND PIT

is opperated by a Corliss 20 h.p. steam engine, and has a capacity of 150 yards per day.

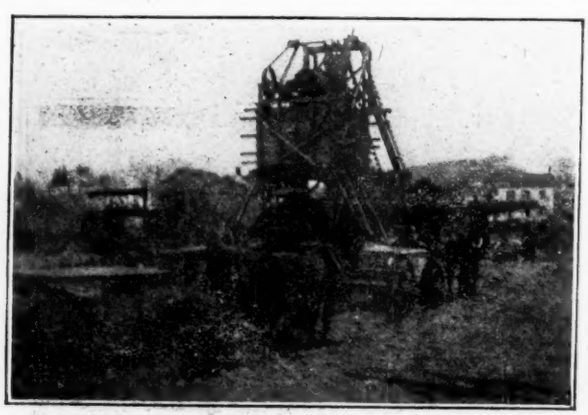
The capacity of the excavating shovel is nearly twice as much as that of the screening plant and part of its product is delivered directly, without screening, to automobile trucks that enter and leave the sand pit on a plank incline and deliver the unscreened sand to purchasers who use it for fill and to the contractor's own trucks for use as fill on the low part of the contract. Four trucks of 4 and 5 yards capacity haul the fill a maximum distance of two miles, making a round trip in about 40 minutes.

SONE QUARRY AND CRUSHER PLANT

Trap-rock for concrete is produced at the rate of a little more than 100 yards per day in a quarry leased, opened and equipped by the contractor on a hillside about 4½ miles from the most remote point of the contract and operated on sub-contract by an independent superintendent.

This quarry has a nearly vertical face about 40 feet high and 100 feet long, requires little stripping and furnishes satisfactory materials which break into small-size stones without much block drilling or sledging. Usually the ledge is shattered by drilling two tiers of holes about 20 feet deep and 8 feet apart in both directions. The holes are drilled by a Wood impact drill, operated by steam, and each vertical hole is charged with cartridges of 60 per cent dynamite.

The shattered stone is loaded by hand into dump cars on industrial tracks and pulled by teams a maximum distance of 150 feet to the 12x24-inch Reliance jaw crusher, the product of which is handled in a standard screening and storage plant having overhead bins with about 100 yards capacity provided with five bottom gates through which the stone is delivered to trucks. The average product of the quarry is about 20 yards of screenings, 15 yards of ¾ inch, 50 yards of 1½-inch and 40 yards of 2-inch stone in one 9-hour shift. The 2-inch stone is rejected from the screens and is recrushed in a Farrell crusher which is operated about half the time and delivers to a smaller portable bin, with a capacity of 40 yards storage and four side spouts for loading trucks. The stone crushers are operated by a 10x12 inch Farquhar engine with a 50-h.p. steam boiler, which also supplies steam for the rock drill.



CRUSHING AND SCREENING PLANT AT QUARRY

CONTRACTORS YARD

Adjacent to the sand pit, the general equipment and storage yard for the work has been established, with a 200-foot railroad track siding one end of which is occupied by a 14x75-foot cement storage shed with a capacity of about 5 carloads or 1500 barrels. There is a 12x24-foot tool shed, an 8x12-foot gasoline shed (in which there are generally maintained ten 60-gallon tanks), an 8x12-foot oil house containing five 60-gallon tanks and various small barrels and tanks for kerosene, lubricating oils, etc. There is a 10x10-foot smith shop, several small sheds and a 20x20-foot mess and bunk tent.

There is also a 10x12-foot empty bag storage shed in charge of a man who is constantly employed in gathering up bags, shaking and folding an average amount, when the work is in full progress, of 900 bags a day which, at the present price of 25c each, makes an important item of saving and allowing for losses should amount to over $30,000 for the 125,000 bags required on the contract. It has been found necessary to pay particular attention to this point because, without it, large numbers of bags are lost, stolen or destroyed.

Besides the trucks employed in handling the materials, there is a 1½-ton Republic utility truck with a detachable cover used for general service and for bringing the men back and forth from their work. The superintendent also has a five-passenger touring car in constant service.

CONSTRUCTION OPERATIONS

Where there is no excavation, the surface of the road is loosened by rooter plows (of which there are three) drawn by one of the two 10-ton Buffalo rollers. The fill, if any, is deposited on the prepared surface and rolled to grade with an accurancy of about ½ inch.

Abundance of broken stone and sand delivered by the automobile trucks are always deposited on the subgrade in advance of the concreting, sufficient for at least two days supply. Considerable difficulty has however been experienced in securing cement, the lack of which has frequently caused the concreting to be shut down entirely for several days at a time.

FINISHING CONCRETE ROAD IN REAR OF PAVER

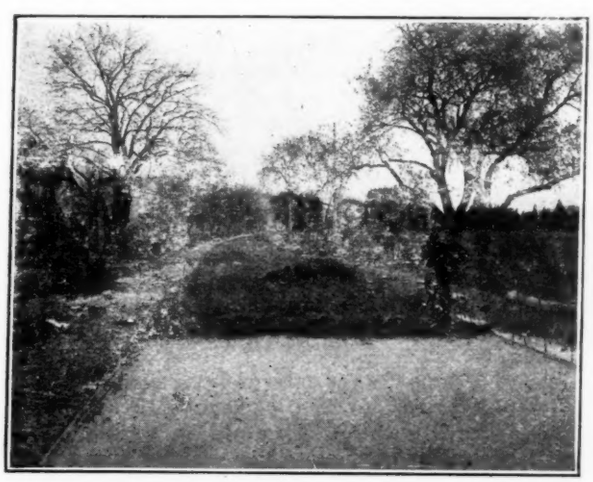
At the site the cement is stored in lots of 200 bags which are piled solidly on 20-inch x 22-foot platforms made of a pair of 2-inch planks cleated together and covered with heavy tar paper. With each platform there is provided one 18x30-foot or one 15x25-foot tarpaulin to protect the cement bags from rain.

A large number of Blaw steel forms are provided and are kept set for about 200 feet in the rear of the concreting machine and for about 900 feet in advance of it.

The concrete is mixed in a 1-yard Koehring machine supplied by 11 wheelbarrow men. The concrete is laid in sections 12 to 15 feet long, with expansion joints 75 feet apart, at an average rate of 300 linear feet in one 9-hour shift, a speed which it is expected will be increased if a sufficient supply of cement can be maintained in advance.

After the concrete has been placed it is finished by a Lakewood machine operated about one-half the time. In special places, however, wherever the consistency of the concrete requires it, the road surface is additionally finished by working with a long-handled two-section hand roller.

Water for the concrete mixer and for saturating the hay with which the fresh concrete surface is kept covered for several days after its completion, is delivered along the full length of the line through a special pressure pipe installed by the contractor, which is supplied from a very large spring a mile from the roadway, where there is located a 2x3x3-inch Cameron steam pump which maintains a pressure of about 80 pounds in the 2½-inch pipe line which is reduced to 2 inches at the further end. The line is run in both directions and pieces are taken off at one end and put on at the other as the work advances.



FRESH CONCRETE COVERED WITH WET HAY

In order to protect the fresh concrete from rain, there are provided enough 12x18-foot covers to suffice for one day's run and these, being kept always a short distance in the rear of the concrete machine, can be almost instantly put in place on the approach of a storm or when the work is left at night. Each frame is a skeleton roof about 24 inches high in the center and with a pitch of 10 inches from the longitudinal line in both directions. It is covered with chicken wire on which there is a layer of the best tar paper. Each frame can be quickly and easily handled by four men and their use gives security against any damage by violent showers.

The full mixer gang requires about 30 men and the maximum force employed on the entire contract at one time is 75 men, who receive as high as $7 each per day for common labor.

All of the contract work is now completed except the concrete which, having been delayed by lack of cement and by backwardness in securing right of way, was only about 75 per cent completed on July 1st.

Large-Scale Gravity Storing and Handling for Road Materials

The W. Z. Williams Company, Macon, Ga., is now building 6½ miles of concrete highway in Bibb County, Georgia, with an equipment carefully designed to reduce to almost nothing the labor of handling the concrete materials.

Cement, broken stone and sand are delivered by the railroads to a spur of the Macon and Birmingham Railroad that crosses at right angles the high way under construction near its center point. The spur is run over a long trestle built of timber and containing, under the standard-gage track, a 4,000-ton storage bin 540 feet long into which the standard-gage 12-yard dump cars and gondolas in which the aggregate is received are dumped, as hauled by the locamotives.

Close to the trestle and adjacent to another spur of the railroad is a cement storage house about 250 feet long.

A 24-inch-gage service track runs under the trestle bin from end to end, passes close to and parallel with the cement house and is continued a short distance to the highway, where it branches in both directions and is extended to the ends of the construction work. On this service track there are installed 42 Western roadbuilders' trucks, each equipped with two Western steel batch boxes of 1-yard capacity. The trains of cars and batch boxes are run under the storage bin, from which they are filled by gravity, cement bags are emptied into them from the loading platform at a lower level as they pass the cement house, and they are hauled by three Whitcomb gasoline geared locomotives to the mixer, where the batch boxes are unloaded as required by a standard crane attachment, which dumps the contents into the mixer skip.

Each gasoline locomotive hauls a train of 10 to 13 cars of concrete materials to the mixer, and the use of the batch boxes and car delivery is estimated to save the labor of 20 wheelbarrow men at the mixing machine.

Besides the equipment enumerated, there is a four-bag Koehring mixer, a Lakewood concrete road paver, a Lakewood subgrader, an Austin "Giant" road grader, a Kelly-Springfield road roller, a Western service car, Blaw-Knox steel forms and the usual equipment of wheel and drag scrapers and plows.

The contractors were fortunate in being able to locate a site with topography favorable to the installation of this plant, and in being able to build the storage bin so that most of the material could be salvaged after the competion of the job, and so that the bin planks could be sawed in a local mill already installed in the vicinity by the contractor.

Limiting Motor Truck Loads

No class of pavement has yet been suggested as practicable which can withstand the heaviest loads which truck manufacturers can construct their vehicles to carry. Even the toughest granite block pavement would rapidly wear away were a railroad locomotive to pass frequently over it, while most of the soils available for highway foundations would yield under such enormous weights even though covered by the thickest practicable foundation. It seems to be generally admitted, therefore, even by the manufacturers of trucks, that it is necessary to place some limit on truck weight in order to prevent the rapid destruction of the roads.

Discussing this subject, R. E. Fulton, vice-president of the International Motor Company, has stated recently that "It is but equitable that those vehicles which cause the greatest amount of damage to the roads should be restricted in their use at the present time, and that in the future they should contribute the largest share toward road repair costs." He cautions, however, against reducing the maximum load to too low a limit, using the following figures in support of his belief. He states that 300,000,000 tons of material were shipped by truck in 1919. If this had been carried by one-ton trucks it would have meant 900,000,000 tons passing over the road, 600,000,000 of it being the weight of the trucks. A 7½-ton truck, however, weighs somewhat less than 7½ tons itself, and consequently if the 300,000,000 tons had been carried in 7½-ton trucks, the roads would have had to bear only 600,000,000 tons of traffic.

The amount of material which must of necessity be carried by trucks is increasing rapidly, partly because of the lack of railroad transportation facilities. If a given amount of such material must be carried by 2½-ton trucks instead of 7½-ton trucks, it will mean three times as many vehicles and probably double the burden on the roads. This will mean increased road wear as well as increased cost of transportation.

The light-weight truck has the advantage over the heavier one of greater speed, and must utilize this advantage to minimize the cost of transportation. This increased speed however, produces road wear in excess of that caused by the heavy truck, although carrying a much less load.

Another point introduced by Mr. Fulton is that of impact. He states that the tests of the United States Bureau of Public Roads show that the road impact is the real cause of road wear and that the "unsprung weight" is the controlling factor in road impact, unsprung weight being that part of a truck's total weight which hits the road a direct blow undiminished by springs. For this season a chain-drive truck, in which all of the driving mechanism is carried on the frame above the springs, has less unsprung weight than a shaft-driven truck, in which the entire weight of the final drive and its housing rides directly on the rear axle below the springs.

"The tests at Washington showed that a 5½-ton chain driven truck produced only 68 per cent of the road impact delivered by a 3-ton shaft driven truck, although the larger truck naturally carried a heavier load."

Effect of Storage on Cement

Results of twenty-five hundred tests show deterioration of strength under all conditions and lengthening of time of setting.

Researches in the properties of concrete and concrete materials at the Structural Materials Research Laboratory are being carried out through the cooperation of the Lewis Institute and the Portland Cement Association, Chicago. At the April meeting of that association, Duff A. Abrams submitted a report on certain tests of the effect of storage of portland cement in different kinds of packages and under different conditions on its concrete and mortar-making properties. The following is a summary of that report:

Tests were made on three different lots of portland cement, which had been in storage for periods up to two years. The cements were stored (A) in the laboratory; (B) in the basement of the building; and (C) in a shed in the yard. In general the cement was stored in lots of 800 to 1,200 pounds, in standard cloth sacks; in one group of tests two brands of paper sacks were also used. In another group the cloth sack containers were covered with thin layers of (1) portland cement and (2) hydrated lime. Tests were made at ages of 7 and 28 days, 3 months, 1 and 2 years, on samples taken immediately upon receipt from the dealers' warehouses and after storage for 3 and 6 months, 1 and 2 years.

This report includes compression tests of about 1,000 6x12-inch concrete cylinders, about 1,000 2x4 inch cylinders of 1-3 standard sand mortar, and about 500 miscellaneous tests. Tests have

been under way for 3½ years; some of the later tests are incomplete as this report is written.

The following are the principal conclusions from this investigation:

(1) There was no essential discrepancy between the indications of the compression tests of 1:5 concrete in the form of 6x12-inch cylinders and the tests on 1:3 standard Ottawa sand mortar in 2x4-inch cylinders.

(2) Compression tests of concrete and mortar showed a deterioration in strength with storage of cement for all samples, for all conditions and periods of storage and at all test ages. The deterioration was greatest for the samples stored in the shed in yard, and least for the samples stored in the laboratory. The basement storage was nearly as severe as outdoor. The deterioration was greater during the first 3 months than for later 3-month periods. A greater deterioration was found in the tests made at the age of 7 days than at 28 days and later test ages.

(3) After 3-month storage in shed in yard the cement had 80 per cent of its original strength; after 6-month storage, 71 per cent; after 1-year, 61 per cent; after 2-year, 40 per cent. The deterioration was probably greater in these tests than would be found in a larger lot of cement stored under similar conditions.

(4) The effect of storage of cement on the concrete or mortar strength is largely a question of the age at which concrete or mortar is tested. The average strength of cement stored in shed in yard when tested at 7 days (for all periods of storage) is 64 per cent of the strength when received from the warehouse; at 28 days, 71 per cent; at 6 months, 78 per cent; at 1 year, 82 per cent, and at 2 years, 85 per cent. A somewhat similar relation is found for other storage conditions. It is a matter of the utmost importance to note that the strength of concrete is not permanently reduced to the low values found in the 7 and 28-day tests.

(5) For periods up to 1½ years there was no marked difference in the quality of cement stored in cloth and in paper sacks. The two brands of paper sacks gave almost identical results.

(6) Only a slight advantage was found from the protection of cement in cloth sacks which were covered by thin layers of Portland cement or hydrated lime. The results obtained do not justify the cost of this method of protecting cement stored in sacks.

(7) The most favorable storage condition (in laboratory) and the least favorable (in basement and shed) gave strengths of the same order of magnitude; indicating that the possibilities of improving the storage condition of cement in sacks in this climate is rather limited. The storage period and the age of the concrete or mortar at test are of greater importance than the exact condition of the storage, so long as the cement is protected from direct contact with moisture.

(8) Storage of cement prolongs the time of initial and final setting.

(10) The normal consistency was only slightly affected by storage.

(12) The deterioration of cement in storage appears to be due to absorption of atmospheric moisture, causing a partial hydration which exhibits itself in reducing the early strength of the concrete and prolonging the time of setting.

Only a negligible quantity of lumps were formed up to 1 year storage. The lumps found in the sacks after storage for more than 1 year presents a puzzling feature of such tests; they were generally discarded before testing the cement. Tests on concrete using only broken lumps as cement gave considerable strength.

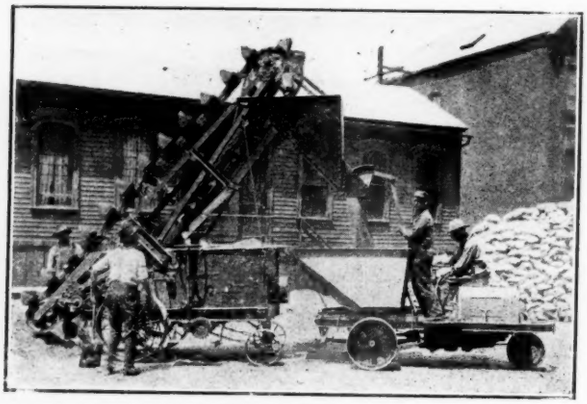
This series of tests did not include bulk storage of cement, however, there is reason to believe that cement may be stored in bulk for long periods without materially affecting its concrete and mortar-making qualities.

Machinery in Alley Paving

Force of a contractor in Chicago reduced one-third and output increased one-fourth after introduction of full mechanical equipment.

The Schmidt Construction Company of Chicago, in constructing concrete pavement in alleys in that city, is using a very complete equipment of machinery and has thus reduced the average number of men employed from 32 to 20. Moreover, where formerly their maximum daily output was 600 square yards, the average since using the full mechanical equipment is about 750 square yards.

LOADING SAND INTO TRUCTRACTOR

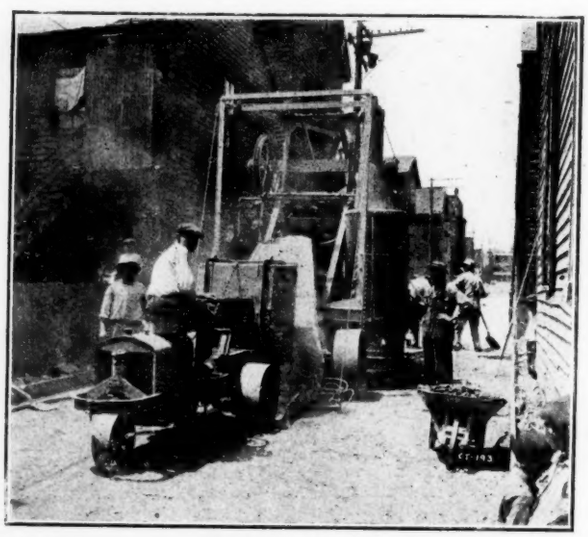


LOADING SAND FROM PILE TO TRUCK

The alley paving work is scattered about in different part of the city, making it necessary to move the machinery from job to job every few days. Consequently, portability of the machinery is an important consideration.

The average width of alleys being paved is 15 feet 4 in. The specifications call for concrete mixed 1:2:3 and laid 7 inches thick. The average alley job consists of about 1,000 square yards of pavement. In carrying on the work the contractor uses a Jeffery automatic loader, a Barber-Greene loader, a Koehring mixer and three gasoline propelled Clark "tructractors."

The Jeffrey loader is located at the sand storage pile and the Barber-Greene loader at the stone storage pile. Each of these is provided with a measuring hopper into which the buckets of the loader discharge. The tructractor runs under the hopper mouth of the loader and receives from one 6 cubic feet of sand, and from the other 9 cubic feet of stone, and three bags of cement are added to them by hand by laborers. The dry materials are then hauled by the tructractors and dumped directly into the skip of the concrete mixer. The round trip haul from mixer to the two loaders and return is 1,000 feet, and is made in three minutes; therefore with three tructractors a batch a minute can be delivered to the mixer. The average day's output of 750 square yards is equivalent to about 146 cubic yards, or 18 cubic yards per hour. As a batch is a little less than one-half a yard, the outfit is apparently turning out about 40 batches an hour or a little better. This is certainly a good record for an average daily performance.



DELIVERING AGGREGATE INTO SKIP OF MIXER

The number of men employed on the work comprises one engineer and two laborers for each of the two loaders, two laborers loading cement, three men operating the tructractors, and nine men at the mixer, these last consisting of four laborers on the wet side, two laborers on the dry side, two mechanics and one fireman. This gives a total of twelve laborers and eight skilled men.

Operation of Sewage Treatment Plants

Studies of large plants of all types being made by the U. S. Public Health Service, with special attention to the sludge problem.

We have stated repeatedly, and unfortunately it still remains true, that although some of the best engineering talent of the country is used in designing sewage treatment plants, and millions are spent every year in constructing them, in a great majority of all but the largest plants the operation and upkeep are given little thought and it becomes a matter of apparent indifference whether or not the plants function as they were intended or produce the results which it was their purpose to attain. We would not even dispute the claims made by some authorities that not more than one per cent of the sewage treatment plants of the country are giving even approximately as good results as they should.

Even those plants which are operated with a fair degree of success do not often furnish for the profession the exact data which are necessary for a thorough study of the operating features of sewage treatment, and this also is of considerable importance to the development of the art.

Chiefly to collect and compare operating data and results, the United States Public Health Service has begun a survey of some of the larger sewage treatment plants of the country, these including the plants at Canton and Alliance, where there is tank treatment followed by contact beds; at Rochester, where there are screens and tanks, and also tanks and filters; at Columbus, Fitchburg, Baltimore, Reading, Atlanta and Lexington, where there are tanks and filters; at Dallas where there are tanks; and at Houston where there is activated sludge. It is possible also that the activated sludge plant at San Marcos, Texas, will be studied.

Through the courtesy of H. B. Hommon, associate sanitary engineer of the Service, under whose charge the investigation is being made,

we are able to give an outline of the plans of the Service.

It is proposed that an engineer and chemist visit each plant, the engineer first collecting the data and the chemist remaining at the plant for about two weeks making analyses and recording results. The form sheets for recording the data have been prepared and seem to cover all possible information which could aid in the study of the plant. The main divisions of the data are classified under the heads of the sewerage system, sewage pumping, data concerning sewage at entrance to treatment plant, description of the sewage treatment plant (this being subdivided into sewer outlet, grit chambers, fine screens, sedimentation tanks, chemical precipitation, sludge production, activated sludge and filters) ultimate disposal of sewage, cost data, and general information. The chemical analyses provide for determination of settleable solids, suspended solids, oxygen consumed, alkalinity, chlorine, nitrites and nitrates, relative stability, fats in raw sewage; also analyses of the sludge, including specific gravity, per cent moisture, volatile matter, nitrogen, fats, alkalinity or acidity, and free CO_2.

It is apparent from the inclusiveness of these data that it is the aim of the investigators to obtain information about everything pertaining to the installation and operation of the sewage treatment plants. Says Mr. Hommon: "We are laying special emphasis on what the men in charge of the various plants think is the cause of foaming in Imhoff tanks and what their remedy is for stopping it. We are also laying stress on what farmers and vegetable growers think of sewage sludge as a fertilizer, how they haul it and how far, and what method is used for distributing it over the land; also what vegetables or other farm crops are most benefited by the use of sludge, and further, how the farmers compare sewage sludge with manure. Our engineer goes among the farmers and gets their personal opinions and takes pictures of growing crops. This part of our survey has become very interesting and I was surprised to learn how well the farmers think of sludge as a fertilizer and to see what little attempt has been made to encourage the farmers to use it, that is, by way of placing the sludge convenient for loading and hauling. As manure becomes scarce in our large cities, some cheap fertilizer must be found to take its place and I believe sewage sludge is the nearest substitute and it may be a better one. I expect to collect a lot of valuable data on this subject.

"We are collecting data on the filtering material used in filters. This pertains particularly to deterioration. We are opening the beds to examine the media and incidentally we are reporting on clogging, worm and bug life and anything that is unusual.

"Our engineer is also endeavoring to learn whether there is any deterioration of concrete due to some constituent of the sewage.

"We are also getting data on the cost of operating treatment plants and an itemized account of the skilled and unskilled labor employed. We are dividing this to show amount paid for actual operation and for upkeep of grounds.

"The questions of deep and shallow Imhoff tanks and the depths of sprinkling filters are also under consideration and we are trying to get an expression of opinion regarding these subjects from those who are actually in charge of the plants.

"Our men, without revealing their identity, are interviewing residents in the neighborhood of the treatment plants to learn how far odors extend from the plants.

"The chemist is analyzing 24-hour, hourly composite samples of the raw waste, and effluents of tank and filters over a period of two weeks. In addition, he is collecting the chemical data obtained at each plant during the previous year.

"We are making a special attempt to get analyses of the fats in the composite raw sewage and in the sewage reaching the plant following the three meals of the day. It has always occurred to me that if fats from sewage were ever to be recovered in a practical way they would have to be collected from the sewage following meals. Our chemist is also determining the fats in the sewage sludge, along with the nitrogen and other fertilizing ingredients.

"The chemist is also endeavoring to learn something about the composition of sludge that will show whether a tank is working properly. He is determining the reaction of the sludge filtrate to show whether the water in the sludge is acid or alkaline and to what extent. He is also determining the specific gravity and per cent moisture of the sludge.

"The settleable solids in all the samples are being obtained and the settleable solids by weight in the raw sewage.

"In connection with the chemical work, it is proposed to endeavor to establish uniform methods of making analyses and standard forms for reporting results, this applying particularly to plants where only a small amount of chemical work is being done and where comparatively inexperienced men are in charge of the plants."

Briefly stated, the purpose of this survey is:

1. To obtain first-hand information regarding the results that are being obtained in the treatment plants of this country, to be used in answering inquiries from cities and towns which are contemplating the installation of treatment plants and want information regarding the plants in operation.

2. To secure accurate information by the same engineer and chemists from the various plants and report it in such manner that engineers can draw conclusions regarding the comparative merits of the various devices used in sewage treatment plants.

3. To collect data regarding the use of sludge as a fertilizer, with especial emphasis on securing evidence from the farmers and gardeners. The purpose of this is to show how far sludge is being utilized and suggest how its use can be encouraged.

4. To prepare a report which will include a

complete description of the plants, including reasons for installation and relief obtained, and giving a general plan of each plant and containing a cross-section of the principal devices; also including a few pictures illustrating special features.

Federal Department of Public Works

The creation by Congress of a national Department of Public Works is now said to depend on the efforts of contractors, architects and engineers to secure sufficient support for it in the next session of Congress. The bulletin of the Associated General Contractors' of America urges the members to make speeches, explain why a public works department is wanted, and give abundant financial support. A strong appeal is made for subscriptions to a working fund of $10,000 to promote the creation of the department and a letter, approved by the president and secretary of the association, has been mailed to the members and has already elicited a number of worth while subscriptions and the promises of more. The letter is as follows:

May 31, 1920.

"We will be benefitted more than any other body of men by the creation of a National Department of Public Works, for the establishment of this department will mean the grouping together of Federal bureaus charged with the expenditure of more than two hundred fify million dollars' worth of public money.

In the past this work has not been considered worth going after. There has been too much red tape about it—too much diversity of specification—too little certainty that good business methods would be used. And so most of us have stayed away from it.

If it were handled by business men in a business way it would be well worth our while. It would mean the opening of practically a new field to us.

The engineers and architects have done most of the work that has been done towards the enactment of the bill so far. They are all back of it, and the department is going to be established. But they ask that we carry our share of the load.

Sixty thousand dollars is required to meet the expenses of the Association. They ask that we furnish ten thousand dollars of this amount. That means about twenty dollars for each member of our Association. Let everybody get behind this thing and help put it across. Fill out the subscription blank and send it to Secretary Buchholz. He will forward it on. Don't put this off. It is up to us to carry our part of the load.

Very truly yours,
F. L. CRANFORD

New York Dock Improvements

The Dock Department of New York City is engaged in carrying out an ambitious plan of water front improvements, far eclipsing anything before undertaken by the city in the way of terminal improvements. Twelve piers are being built on Staten Island which are estimated to cost $18,000,000 and which range in length from 1,000 feet to 1,600. Eight of these will be 125 feet wide, covered with steel freight sheets, two will be 130 feet wide, with double-deck steel freight sheets, and two will be 209 feet wide with double-deck steel frieght sheds Ten of the piers have provision for a double track railroad.

Also there are contemplated a wooden pier at Barren Island for the Street Cleaning Department and a concrete pier for the same purpose and the reconstruction of a pier for the Board of Charities and Correction. Much additional work of only less importance is planned. Bids have been opened for dredging a Long Island City basin and basins and docks in the North, East and Harlem rivers. An extension platform about 100 feet long is being built for excursion steam boats on the easterly front of Battery Park. A number of storage sheds, piers, etc., are to be built in various parts of the water front, by both municipal and private owners or lessees.

Harbor Project of Wilmington, Delaware

The plans for the Wilmington, Del., harbor project have been completed. They call for a bulkhead along Christiana creek, eventually to be fifty-one hundred feet in length, but with an initial limit of about sixteen hundred feet. Back of the bulkhead will be transit sheds, storage warehouses and various tracks.

The municipal wharf is already about eighty per cent completed. It is being utilized now, and numerous calls for docking privileges have been received.

Reports from many employers in Cleveland and surrounding centers, say that labor is showing a disposition to give a better day's work for its wages than has been reported for many months past.

Industrial Harbor for Lake Calumet

The Harbor Commission of Chicago's City Council is considering plans for a large industrial harbor at Lake Calumet, which would form a link in the "Lakes to Gulf" waterway. The project includes 93 acres of water area for the harbor, a central basin of 471 acres, 14 miles of water frontage and 14 huge slips. A belt line railroad having connections with 15 railroads would surround the harbor.

Power for Alabama from Mussel Shoals

At the present time forty cities in Alabama, several car lines, 35 coal mines, many cotton mills and graphite mills, and others are operated by 90,000 horsepower available from the Coosa development; but with the completion of the dam at Muscle Shoals there will be available 830,000 hydro-electric horsepower. Construction of this dam has so far progressed that bids have been received for installing electrical apparatus to produce 120,000 hydro-electric horsepower, which is one-fourth of the total power available at this point.

Subway Contract Relet

The contract for the completion of the 14th St. Subway, New York, which was commenced several years ago by the Degnon Contracting Company and abandoned after the city refused to allow an increase in the price following the advance in cost, has just been awarded to Patrick McGovern for $3,364,000 and is required to be completed in 15 months.

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Studying Sewage Plant Operation

Reporting on the considerable number of sewage treatment plants in his state recently, a State Health Officer said that the majority of them "at least did the sewage no harm" but that very few of them were of any appreciable benefit; this being due to inefficient operation rather than improper designing, in the majority of cases.

A water works filter is generally operated with great care because every consumer is interested in the results obtained by it, but a sewage treatment plant is of little interest to any one in the city operating it and consequently receives little attention or thought. It was probably built merely to meet legal requirements of state laws enforced by a State Board of Health or by the courts through injuction proceedings, and the plant having once been completed satisfactorily, the courts lose all interest in it and the State Health Board has not a sufficient force to permit keeping track of the operation of all plants.

This neglect of operation not only results in a failure to secure effective results from the money spent and to permanently eliminate the nuisance which led to the construction, but very greatly reduces our knowledge concerning the operation of such plants and thereby retards the development of the science and art of both operating and constructing them.

As described elsewhere in this issue, the United States Public Health Service has begun a survey of a number of plants, including examples of all of the more commonly used types, with the idea of placing in publicly available form all the information obtainable concerning these plants, and also reducing it to equivalent terms so as to make possible a reliable comparison of results in plants operating upon different principles and under different conditions.

There can be little doubt of the value of sanitary engineers of this investigation, and it is hoped that it will stimulate more interest in the subject and result n the adoption of uniform methods of keeping records which will permit a comparative study of plants, gradually including practically all of those in the country, and thus make for a much more rapid and general advancement of the science of sewage treatment.

As a beginning of this spread of interest from federal to local authorities, it is natural and desirable that state health boards take more active control of the operation of all the sewage treatment plants in their respective states. Many of them are not given sufficient funds to permit this, and the first move would be an education of the legislators and public to the desirablity of such supervision. In such education it would seem as though the Public Health Service might render much help.

Economics of a Great Aqueduct

The Winnipeg aqueduct, which consists chiefly of a concrete conduit nearly 100 miles long with a capacity for 100,000,000 imperial gallons daily was, on account of its magnitude, location, and requirements, a necessarily costly construction the minimum burden of which was very heavy for the new and thinly settled country in which it was built.

It was therefore recognized by the experts who were retained to plan the general system that the greatest simplicity and economy consistent with safety and efficiency were indispensable, and the general plans adopted in 1913 were based on these principles and contemplated a structure reduced almost to its lowest terms.

The construction of the aqueduct almost entirely within the period of the great war subjected it to conditions very different from those anticipated in the original design and involved greatly increased cost of labor and materials, scarcity of numbers and inferiority of quality in workmen, and other disadvantages that would naturally greatly increase the cost and delay the work. Nevertheless it was found possible to maintain the quality of the work and complete it practically within the required limits of time and expense by extraordinary attention to the simplification and accuracy of the design and by special cooperation of the engineering department with the contractors so as to eliminate unnecessary cost and delay and reduce the expense to an absolute minimum.

The character of the design and the scrupulous care with which it was adapted to the varying possibilities of the problem are evident throughout the series of articles commenced in Public Works, July 3.

The construction features involved thorough co-ordination of the city, the engineer's department, and the various contractors and were handled with great skill by the engineer whose foresight, thorough analysis of the problem and tact enabled him to handle the work throughout in such a way as to conduct it to the best interest of the city and often to the advantage of the contractor without in any way impairing its quality, assuming any of the responsibilities of the contractors or interfering with their freedom. This resulted in a large saving of time and money to all parties concerned and in a remarkable continuity and efficiency of the construction operations.

As the aqueduct passes for a large part of its length through swamps and pathless forests where transportation was slow, uncertain and

costly, a great advantage was attained by the city's construction of a parallel service railroad over which the materials, plant and workmen were quickly and regularly delivered to all parts of the work at a much lower cost than could have been done by the contractors independently, and at a minimum total outlay.

This was supplemented by the policy of the city in providing concrete materials that were always ready in abundance and were of uniform and satisfactory quality, permitting the work to be carried on advantageously and eliminating delay, uncertainty and considerable middleman's profit.

An important element in the rapid and sustained progress of the work was the preparation of weekly reports and records of the progress and conditions of construction, which clearly showed if the contractor was up to the mark; and when he was behind time he was promptly penalized, but was reimbursed after he had caught up with the schedule, a system which proved very beneficial and satisfactory.

The engineering department was also well posted in advance as to all future requirements and supplies, and made arrangements to have all local plant and materials on hand on or before the date when they would be needed, thus almost entirely eliminating unnecessary delays and interference of simultaneous or successive operations.

$1,565,000 Wasted on Municipal Construction

The award of a contract for more than $3,000,000 to complete the construction of the 14th St. subway line, New York, is noted on page 106. Although it is probably the best thing that the city can do at the present moment to put this important and much needed transportation unit into service, it involves a wholly unjustifiable and unnecessary waste of at least $1,565,000 of the tax payers' money, a great injustice to honorable and efficient contractors, and a long period of inconvenience and distress to the traveling public, besides the direct injury to the prosperity and development of this city.

The work was originally contracted for by an experienced and competent contractor for the sum of $1,972,349, but was delayed in various ways for which the contractor was not responsible, and the enormous war increase of cost of labor and material made it impossible to complete it for the originally fair price. The contractor, anxious to carry out his obligations and willing to forego the estimated profits, offered to complete it notwithstanding the heavy loss if the city would increase the remuneration by $626,000 over the original price. This offer was approved by John H. Delaney, transit construction comissioner, but rejected by the Board of Estimate, and in July, 1919, after about 35 per cent of the work had been fiinished, the contract was abandoned by the contractor.

After waiting one year during which time costs have considerably increased and the public has been suffering severely for the use of the subway, the Board of Estimate has been compelled to award a new contract at a price including the $626,000 increase petitioned for by the original contractor and the addition of $2,738,000, about $1,565,000 of which is a total loss to the city that would have been saved if the city had granted the contractor's reasonable application, which probably came within the special legislation provided to relieve municipal contractors suffering from war conditions. Unfortunately this law is only permissive and not mandatory, and the city has manifested a consistent determination to avoid such payments, even when promised. This has worked extreme hardship and injustice to many honorable and efficient contractors who have taken pride in executing their obligations notwithstanding heavy losses. It has also subjected the city to very great loss and inconvenience and well earned for it a reputation of unfairness to contractors, which will deter competent contractors from undertaking city work except at prices that would be outrageously high under fair conditions.

Cooperative Housing in Italy

In a periodical called "Housing," issued by the British Government, there appeared recently an article by S. Hurst Seager, describing a novel housing scheme observed by him in Rome. Of the article we have made the following brief abstract:

There are few detached homes in Rome and it is natural therefore, that housing schemes should follow the general plan of arranging a series of houses around a garden. Some of these blocks of houses have interior court yards which are well laid out and planted and some contain a fountain continually playing. An institute has been organized for the building of homes for laborers, and this builds separate houses in blocks of four to six, each with a separate entrance, the houses having nothing to differentiate them from the homes of the well-to-do except that they have only three or four rooms.

The largest scheme in Rome is on the Aventine hill. Here the buildings are erected in a substantial and workmanlike manner under a very interesting system. There are no building contractors, but every branch of work is let to the workers themselves as represented by their unions. The work is not done any more cheaply than if carried out in the ordinary manner, as the primary object of the Institute is not so much to effect a saving as to encourage the men to take a genuine interest in their work; while the object of the unions is to enable their members to carry out work in a cooperative manner and thus be free from the wage system. So far as Mr. Seager could judge, the scheme appeared to achieve these purposes.

He also reports that there are many blocks of dwellings and some groups of individual homes which have been erected on the cooperative principle by those engaged in a particular branch of Government work, such as the railway, post office and telegraphs, etc. To these groups of workers the Government has loaned a large proportion of the required funds at a very low rate of interest.

Concreting Plant and Operations

Conclusion of article begun last week giving a general review of advanced field operations and equipment. This installment deals with mixing machines, distribution and placing of concrete, the pneumatic process, and concreting under water.

MIXING MACHINES

Concrete mixing machines are standard equipment that can always be readily bought and sold in the market. As they are always subject to very hard service, often continuous, and liable to abuse and neglect, it is essential that they be of simple design, heavy construction and first-class material and workmanship. Most of them are of the drum type with revolving body and interior blades, which lift and drop the aggregate until it is well separated and mixed, the principal differences being in the details and in the manner of charging and discharging them. Considerable variation is found in the different patterns that are specially adapted for diffent kinds of work, those for paving, for instance, being entirely different from those for building construction.

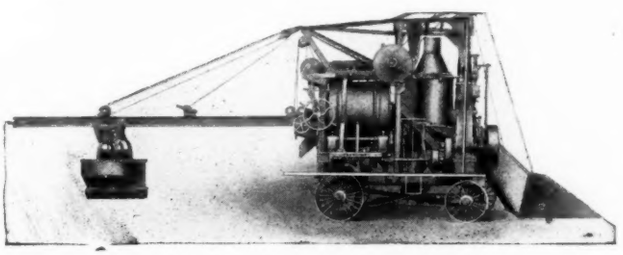
They can be purchased of varying size from a fraction of a yard to several yards capacity, but the general tendency is toward a large number of smaller sized units; one yard machines being about the average for ordinary large jobs. Where concrete is deposited in very large masses and with the greatest rapidity, special larger machines may be used to advantage, but in any case, it is more desirable to have several machines than to have one, because this provides a reserve and allows one or more to be out of service for shifting or repairs without entirely stopping the output. A multiplicity of mixers enables them to be distributed at different parts of a large piece of work, thus diminishing the distance which the mixed concrete must be carried.

It is desirable that all mixers on the job should be of the same make and, as far as possible, of the same size, so as to provide for interchangeability of parts and reduce the extra pieces kept on hand. They may be installed in batteries of two or more; they should be fed from the same bins and operated from the same charging platform, thus reducing the number of attendants and the cost of installation. They should be mounted on steel or timber skids on a solid foundation with suitable protection, and at an elevation sufficient to enable them to discharge directly to the distributing cars or hoisting buckets; if necessary, however, the latter may be placed in the bottom of a pit, thus reducing the elevation of the mixer.

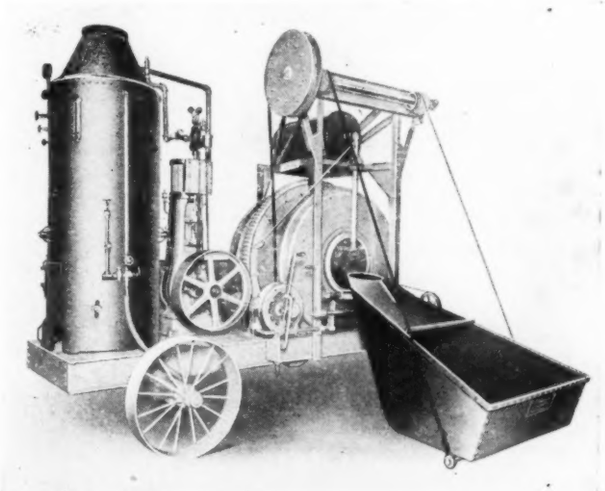
Where small units of construction are to be scattered over a large area, as in the case of foundation piers, long walls, or similar construction, it will be found convenient to have one or more small portable machines moving from place to place according to the progress of the work. Where a daily output of 100 yards or more is required, two small machines are generally better than one larger machine, both because they make a much more elastic system and can be separated and transferred to other work, and because the freight and installation charges are much less than for the equivalent large machine.

LOADING MIXERS

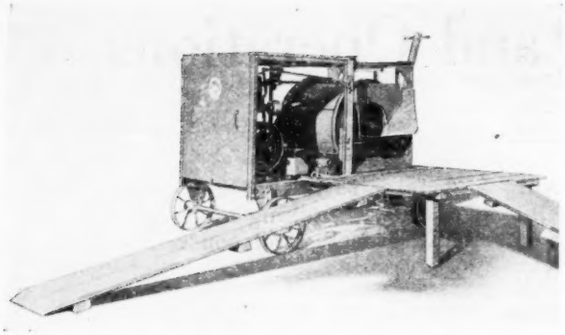
Portable machines are usually equipped with a power loader or a loading platform, the latter usually costing 25 or 30 per cent less than the former, which has 20 or 30 per cent greater capacity than the platform machine. Where conditions limit the amount of concrete required to 50 yards or less daily, the platform machine is probably the most economical. Where these machines are charged by hand shoveling, great care should be taken to establish a minimum consecutive cycle of operation, so that no time is lost or interruption or obstruc-



RANSOME ROAD PAVING MIXER



STEAM DRIVEN BUILDING MIXER WITH CHARGING HOPPER



GASOLINE DRIVEN BANTAM MIXER WITH INCLINED WHEELING PLATFORM

tion occasioned by the men getting in each other's way, or waiting for each other.

Each man or party of men should work continuously in the same routine, particular care being taken to avoid confusion or collision between men approaching and those leaving the charging platform. A one-bag machine will require five wheelbarrow loads of 2 cubic feet capacity for each batch, and as each load requires at least 35 seconds for delivering the material, 10 seconds for operating the hopper, and 30 seconds for mixing, a minimum of 75 seconds will be necessary for each cycle. With wheel-barrows of 3 cubic feet capacity, the cycle may be reduced to a possible 61 seconds, although the tendency is growing to require a full 60 seconds for mixing operations alone.

A power loading machine of 11 cubic feet capacity, called a one-bag machine, requires the same wheelbarrow time for charging but, as the hopper can be loaded while the mixing is in progress, only 12 seconds is required for elevating and discharging the hopper, and the minimum cycle is about 52 seconds. With gravity storage bins, the automatic charging of the hopper requires about the same time for any size batch up to two or three yards capacity; the time of charging will hardly exceed one minute, thus giving a maximum speed of 30 batches per hour allowing a full minute for mixing.

The ideal arrangement of supplies for wheelbarrow charging is to have the sand and broken stone on opposite sides of the mixer, so that a wheelbarrow bringing a load of sand continues in the same direction across the platform and loads with stone returning; delivers the stone and continues to the sand pile; and so on back and forth, shuttle fashion, with no lost time or empty trips.

Water supply should always be carefully measured and fed into the mixer before the sand, cement and broken stone. Since too much water will injure the quality of the concrete and too little will not materiallly affect the operation of the machine, it is better to have too little than too much. In cold weather the water should be heated before being delivered to the machine, which is easily accomplished by running steam coils through the supply tank, or by injecting live or exhaust steam into the water through a perforated or open-end pipe.

HEATING MATERIALS

It is also necessary in very cold weather to provide systematic provision for heating the aggregate. This is best done by installing steam coils on the bottom and around the sides of the storage bins or under the storage piles; low pressure or exhaust steam is satisfactory for this purpose and should be provided in abundant quantities. If the steam supply for operating the mechanical plant is not abundantly adequate, an additional old boiler may well serve the purpose, if installed especially for this service.

For small size, temporary or detached operations, it may suffice to heat the sand, gravel or broken stone over horizontal flues in which a wood, coal or coke fire is maintained. Steam is also sometimes injected into the mixer during its revolution. If the concrete is delivered to position at a temperature well above freezing, and the upper surface is well protected, the heat developed by the chemical processes of setting will usually prevent it from freezing except in extremely cold weather. When concrete is placed in small masses, however, the forms need protection against frost, whenever the temperature is much below freezing.

DISTRIBUTION AND PLACING OF CONCRETE

Concrete mixers usually deliver directly into dump cars or buckets, the former being used when the concrete can be discharged directly into the forms at a lower elevation, as into foundation pits, or from a trestle into wall forms and the like. Concrete buckets are usually transported for short distances by cableways and for longer ones on cars or automobile trucks, whence they are generally unloaded by derricks commanding the forms into which the concrete is emptied. The cableway usually brings the buckets into position over the forms where they are dumped directly, but it may deliver them to derricks or other plant which transfer them to required positions. The buckets should usually be of proper size to take one batch of concrete, unless they have to be transported for long distances, when they may take two or three batches at once. Tilting buckets may be used, but bottom dump buckets are generally preferable and are indispensable for depositing concrete under water. Special buckets with adjustable gates are used for narrow forms and special purposes.

SPOUTING

For building construction, dams and other structures, concrete is frequently delivered from the mixing plant to a bucket at the foot of a hoisting tower, from 50 to 200 feet high, in which it is elevated to a receiving hopper at the top or at any intermediate point, where the contents are dumped. Usually the receiving hopper is provided with a gate through which the concrete is delivered to an inclined tube or trough, which spouts it to different portions of the work. Considerable advantage in spouting is derived from mixing a small proportion of hydrated lime with the cement, which makes the concrete more plastic and slippery. The proportion of mixing water should be about 1¼ to 1½ gallons per cubic foot of concrete.

The chutes are generally made in long sections of steel troughs, trussed and connected at the ends with swivel joints, supported in such a manner as to allow each section to be revolved through a wide horizontal angle, the last section delivering directly to the forms or to a small charging hopper, from which two-wheel carts are filled to transport the

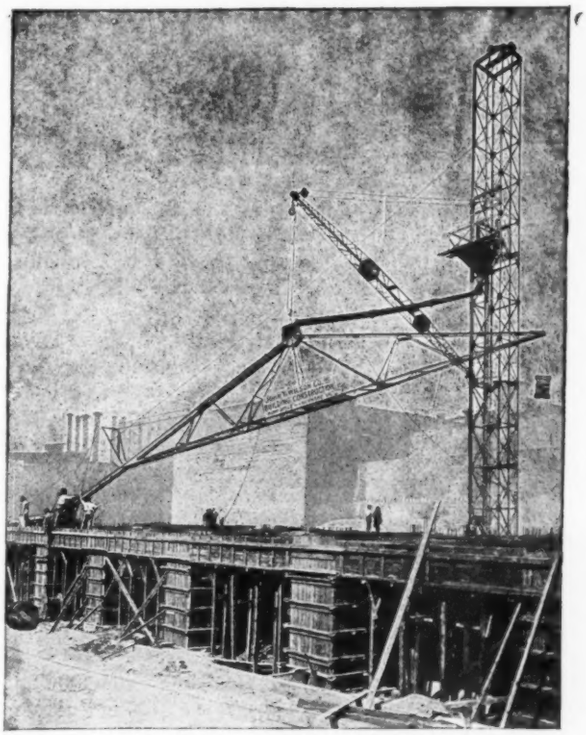
concrete a short distance. About 200 or 300 feet is the ordinary practical limit for spouting concrete (a maximum distance of 700 feet has been recorded), and when this is materially exceeded, sometimes the concrete is delivered to a second bucket at the foot of an auxiliary hoisting tower, where it is elevated and spouted again.

The chutes are often suspended by adjustable light tackles from overhead cables, one end of which is carried at the hoisting tower and the other end at another tower or even extended to the ground beyond the limit of the work. The first end of the chute is always supported directly from the hoisting tower, and sometimes the outer end is carried by a boom attached to the tower, through which the chute passes. A second chute is often carried on the top chords of a cantilever truss and supports one end of a third chute, which generally is supported at the outer end on a light tower or trestle moved from place to place on the work.

PUSH CARTS

When the concrete cannot be spouted to the forms in which it is to be placed, it is generally distributed for distances up to perhaps 100 feet in two-wheel hand-pushed dump carts running on plank platforms laid on the surface of the ground, on the floor, on trestles, or on top of the forms. This final distribution is often used for handling the concrete for large buildings, where the spouting may be eliminated, and the hoisting tower may deliver to loading hoppers on the successive floors.

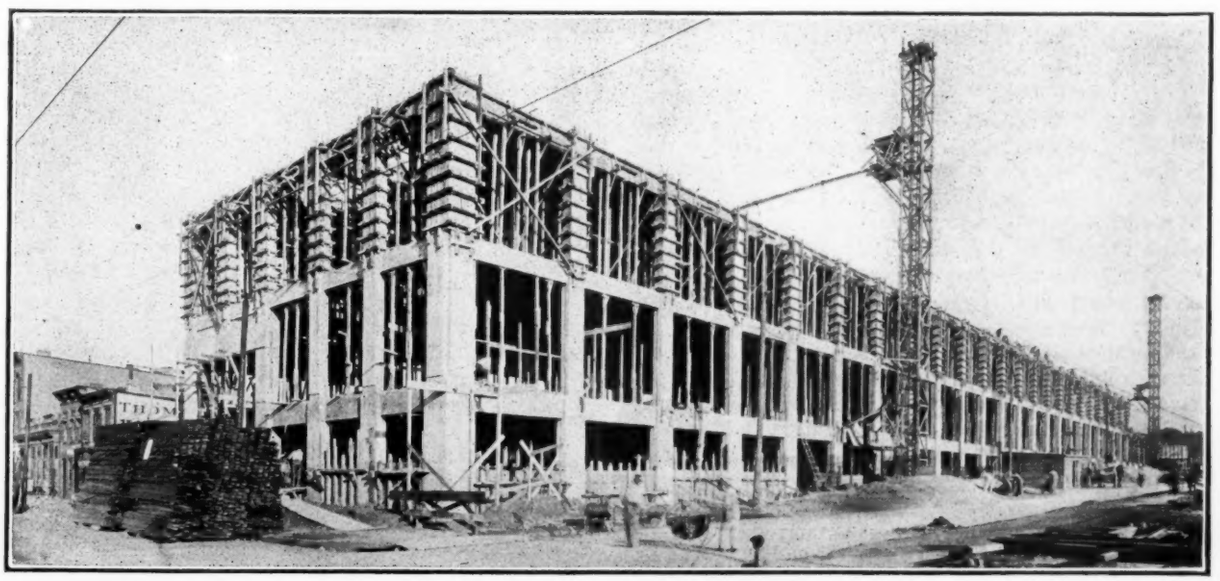
In other cases, the two-wheel carts may receive the concrete directly from the mixer and distribute it up to a maximum distance of several hundred feet. The runways for these carts should be made of light boards, cleated together in panels from 8 to 12 feet long, that can be very readily shifted and easily supported on blocking or trestles to provide for the proper grade, which should be from 1 to 2 inches in 10 feet, in favor of the loaded carts, not sufficient to accelerate their speed unduly or to make severe work pushing the empty carts upgrade.



STEEL HOISTING TOWER WITH COUNTER-BALANCED TRUSSED CHUTES

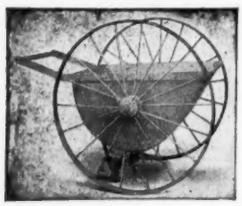
A 250 x 250-foot concrete slab 10 feet thick was concreted from a single mixing machine that delivered into carts running on a platform 6 feet wide and extending across the full width of the concrete slab on the center line. It was elevated about 6 feet above the slab and graded down about 1 to 500. On each side of this platform there was provided at the same level a movable transfer table of the same width, extending across the slab transverse to the main runway.

The 25 two-wheel carts were operated in pairs simultaneously filled from two gates of the loading hopper at the mixer, and one was pushed out on a



CONCRETING SHOP BUILDING WITH DUPLEX SYSTEM OF WOODEN HOISTING TOWERS AND TRUSSED CHUTES

transverse runway on one side and the other on the other side, from which they dumped their contents to the slab and returned. The grade of the runway was sufficient for the loaded cars to move by gravity at a speed which made it necessary for the attendants to hasten and made the work so rapid that it was necessary to relieve the men at short intervals. This method gave 100 per cent efficiency, removing the concrete as fast as the mixer could deliver it, which is an unusual record for any construction work.



CONCRETE CART

PNEUMATIC PROCESS

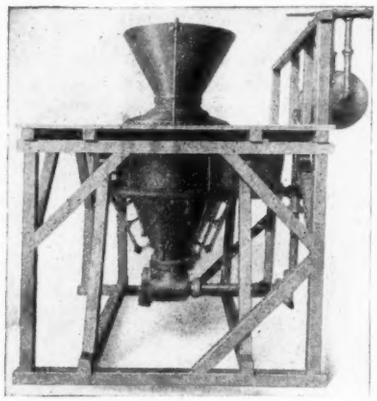
For years the mixing and placing of concrete by pneumatic pressure had been considered a *desideratum*, and considerable progress has been made in developing such a process. There are on the market numerous types of mixing machines in which the cement and aggregate are charged and subjected to jets of compressed air from several nozzles that

PORTABLE STEEL HOPPER

tend to mix the materials; a gate is then opened, and the entire batch is forced through a pipe that discharges into the forms. Considerable difficulty has been experienced in securing a satisfactory and thorough mixture, but good results have been obtained by mixing the cement and aggregate before delivering it to the pneumatic mixer.

The pneumatic conveying portion of the apparatus has however proved very advantageous in some cases, especially where there is very limited clearance; notably in tunnel construction, where concrete for the lining can be delivered from the top or bottom of the shaft through a pipe laid on the invert or along the tunnel wall and occupying so little space that it does not interfere with tunnel cars or the other construction operations. On the other hand, the transportation of concrete in buckets or dump cars would very much obstruct the work, particularly in tunnels of small diameter, where only a single line of track can be used.

The delivery pipe is usually from 4 to 6 or even 8 inches in diameter and can be laid at any grade or even with perpendicular sections, but either horizontal or vertical deflections should be made with long radius bends. The concrete can be delivered



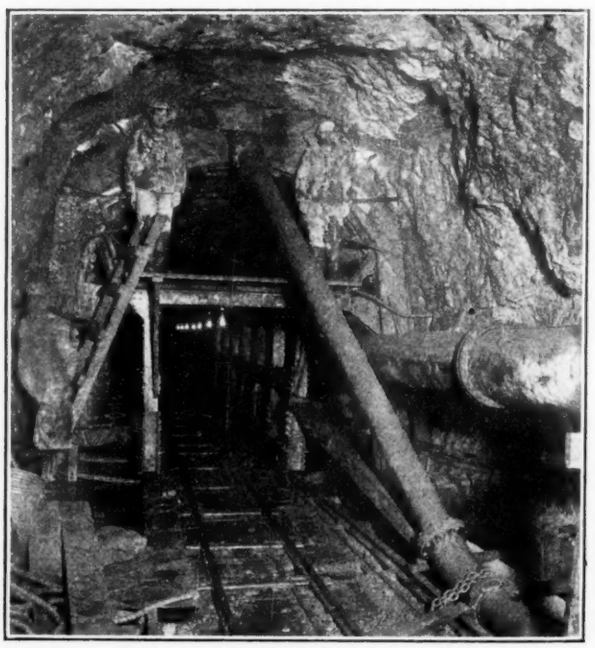
RANSOME-CANIFF PNEUMATIC MIXER AND CONVEYOR

through horizontal distances up to 1,000 feet or more, and can be raised 50 feet with a working pressure of 100 pounds or less.

The system is of course costly to install and it is found to require a very large amount of compressed air for its operation. It may, however, be economical when the cost of placing concrete by other methods exceeds $1.50 per cubic yard. The concrete quickly wears out the pipe at the bends, where holes are cut through the outer side of the curve, and the pieces require frequent patchings or renewal and are generally reinforced or made extra heavy or have detachable pieces at the exposed points.

CONCRETING UNDER WATER

Submerged concrete is usually placed in solid masses not requiring reinforcement or exceptional



CONCRETING TUNNEL LINING BEHIND STEEL FORMS AND STEEL TRAVELER WITH 8-INCH PNEUMATIC PIPE

tension strength. It should, however, completely fill the forms making a solid mass and be protected so as to preserve its integrity until hardened and to prevent the washing away of the cement. Submerged concrete may often be placed in the dry, and water may be excluded until the concreting is completed, as in cases of concrete placed inside pneumatic caissons or cofferdams, or when a structure is concreted in a floating cofferdam sunk to position on a prepared foundation.

This last method is occasionally used for bridge piers, sea walls and the like, where the caisson itself is sometimes a plain or cellular concrete box, or where the system can be adopted that was recently devised by J. W. Rollins. His scheme consisted of building on shore a wooden cofferdam, detachably connected with a water tight joint to a permanent solid concrete base; this box-like structure was launched, towed to position, and gradually sunk on the foundation as the interior permanent structure was built up on the concrete bottom. After the work is brought above water level, the detachable sides can be removed and used over again, thus effecting great economy and rapidity.

With proper care and equipment wet concrete can be safely deposited through and under the water, usually without much and sometimes without any work from divers, which is always costly. However, it may be desirable to have the bottom prepared to receive the concrete or to have it inspected by divers before the concrete is commenced and while it is being placed.

For depositing under water concrete should never be of a lean mixture. Gravel is a more satisfactory aggregate than broken stone, because it flows more easily and is less liable to obstruction and the production of cavities. The materials should be delivered by boat if the water has sufficient depth, in which case the floating plant will usually be more satisfactory for a large job. On the other hand, when the materials are received by rail or the plant can be installed on shore or on an adjacent structure, a fixed plant may be most desirable. Other things being equal, the concrete can be handled from the mixer most advantageously by ordinary derrick booms, although sometimes cableways with very large buckets are suitable.

When a large area is to be covered with submerged concrete, it should be uniformly deposited in a continuous layer, 2 or 3 inches thick, with the strips zig-zagging back and forth continuously across the surface. An irregular surface of fresh concrete may sometimes have to be leveled by a straightedge drag or screen, heavily loaded or operated by divers.

Submerged forms for retaining masses of concrete may be built up to a limited height from an irregular bottom with jute or paper bags of fresh concrete handled by divers and built up like walls. Concrete in small quantities may thus be placed under water for many different purposes, the cement permeating the woven fabric of the bags and making a solid monolithic mass which may or may not be the case when it is placed in paper bags, although the fabric of the latter is generally believed to dissolve and allow the concrete units to bond thoroughly together.

BOTTOM DUMP BUCKETS

Concrete cannot be successfully dumped into the water from a point above the surface nor deposited by lowering through the water in a tilting bucket, because the combined action of water and gravity tend to separate the fine and coarse particles and wash out the cement. The bottom and sides of the concrete should be protected from the water, but the top does not need special protection. A great deal of submerged work can be satisfactorily executed with a good bottom-dumping steel bucket, particularly for small areas and in protected spaces such as the interior of cribs, caisson pockets, and dredged wells, where there is little current of water to be contended with.

A bottom-dump bucket may be provided with a tripping device to release the bottom flaps when it is just above the required emptying position; it is better, however, to have the sides extend a few inches below the bottom flaps and the latter arranged so that when the bucket comes to rest on the lower edges of the sides, the flaps are released; the bucket then automatically discharges its contents, still protected by the extended sides and left exactly in the required position when the bucket is withdrawn.

It is important that the top of the bucket be left open so as to avoid the formation of a partial vacuum that would not only retard the emptying of the bucket, but would eventually set up a washing action that would injure the concrete. Submerged bucket work should be done with large masses of concrete and as little exposure to washing as possible, buckets up to 4 or 5 yards capacity being desirable when conditions permit.

TREMIE METHOD

When there is considerable lateral clearance and a large mass of concrete to be deposited under water, excellent results can be obtained by the tremie method, which consists simply in depositing the concrete through a tube, usually vertical, extending from above water level to the point of deposition of the concrete under water.

The great essential in this method is that the tremie shall be kept always filled with concrete and the operation shall be carried on continuously, so as to cause the uniform distribution of the concrete and maintain a concrete seal at the bottom of the tremie, thus preventing the entrance of water. The tremie, mounted on a carriage that is provided with both transverse and longitudinal motion or supported by a derrick boom or other suitable apparatus, is provided with a hopper at the top which must be kept filled from the adjacent mixer.

At the beginning of operations the tremie is full of water, which is expelled by the first concrete that enters it; the concrete, however, becomes washed in falling to the bottom, so that it should be thrown away and operations commenced with concrete supplied after the first contents of the tube have escaped. The bottom of the tube should be maintained embedded a few inches in the surface of fresh concrete, thus providing a seal and enabling the full length of the tube and part of the hopper to be maintained full of concrete, which can only escape as the bottom of the tube is moved forward

transversely to the end of its course. At this stage it should be shifted slightly longitudinally and moved back in a parallel transverse direction, and thus moved back and forth in a zig-zag fashion until the whole area of the structure has been covered.

In this way the concrete builds up in successive, uniform, continuous, horizontal layers with as little interruption as possible; it may be necessary to raise the tremie and start operations over again if it has to be shifted from pocket to pocket of a caisson, or to avoid horizontal braces. On this account, where the obstructed horizontal area is less than 200 square feet, the use of a bottom-dumping bucket is likely to be more economical than the tremie. The tremie should be large and arranged so as to be easily and accurately handled, and great care should be taken to maintain a continuous supply of concrete and prevent any interruption to its deposition under water.

For the piers of the Charles River Bridge, Boston, many thousands of yards of concrete were deposited in masses up to 62 x 207 feet and at a depth of 30 feet below high water; the tremie used was 35 feet long, 18 inches in diameter at the top and 24 inches at the bottom, and was suspended from a 6-yard hopper car traveling on a transverse bridge. The bridge itself rolled on longitudinal track extending the full length of the cofferdam, and commanded all parts of its area.

The hopper was kept constantly filled with concrete and was discharged through a bottom gate as the car moved, depositing it at the rate of about 40 yards per hour. Another important case of successful tremie concreting was that of the four-track subway tunnel across the Harlem River. There a large quantity of concrete under, around, and over the four steel tubes, and inside a steel cofferdam and bulkhead was placed by several tremies mounted on a floating platform.

Labor Notes

Among the items in the **Industrial News Survey** of July 12 published by the National Industrial Conference Board are the following:

Brotherhood of Surface Employees of Brooklyn, N. Y., rapid transit association has taken out papers of incorporation.

Central Labor Union of Boston has voted that after October 2, 1920, no alien will be eligible as a delegate to that body unless he has taken out citizenship papers or filed his intention of doing so.

Textile Union (Paris) recently passed resolution protesting 48-hour week and declaring that it is an "imperative necessity to restore the maximum production to industry by an intensive effort," and demanding purchase of material and machinery for industries ruined by the war, without further delay; also appealing to public opinion urging strict economy on part of the consumer and increased activity in every department of labor as only true means of combating the high cost of living.

White Motor Co., Cleveland, Ohio, has issued declaration of principles governing its industrial relations which has been approved by committee of elected representatives of workers who meet with the management to consider plant problems. The maxims of the declaration state "Capital is only production minus consumption"; "Business originally founded on service"; "The customer pays all"; "The public suffers all"; "Absentee ownership may or may not be a curse"; "Absentee management is always a curse"; the principles are, "No entangling alliances"; "Free speech"; "Free press"; "Recognition of individual rights"; "No discrimination against nationality, political belief, or creed"; "no discrimination against any organization"; "base wage, based on buying power"; "Craftsman's wages adjusted to the above."

The first maxim, at least, is worthy to be included with the famous "Fourteen Points."

New Orleans Car Strike

The entire transportation system of New Orleans was completely paralyzed July 1, by a strike of the street car employees who, some hours after quitting work, announced that they were ready to discuss their differences with the federal receiver for the New Orleans Railway and Light Company, on whom they placed the responsibility because they charge him with having failed to grant them a wage of $150 per month that has been suggested as a living wage. The chairman of the Business Mens' Committee considered that the committee had been treated shamefully when, after endeavoring to avoid the strike, they sent a petition to the strikers before the latter took action, which was not even acknowledged.

Another Closed Shop Strike

A strike on the municipal contractors for garbage disposal in Philadelphia is emphatically stated by the employees to be a fight for closed shop, the demands of the strikers not being a genuine popular request, but being made at the dictation of a few agitators although the men themselves desire to work.

Distribution of Immigrants

The official money-changer for incoming aliens landing in New York is quoted as stating that the money exchanged for those whose destination is New York City does not amount to 1 per cent of that exchanged for those giving other points as their destination. The immigrants are now going in greatly increased proportion to manufacturing centers such as Pittsburgh, Detroit and Akron, Ohio or to the coal and iron mining regions.

Immigration to New York

The present rate of immigration to New York City, about 10,000 per weak, is only one-quarter as great as the pre-war maximum, but a considerable portion of the diminution is attributed to the loss during the war of 25 large passenger ships. It is also influenced by literacy tests and

by the efforts of the European governments to keep their citizens at home. Out of the 10,000 weekly arrivals, 6,000 are women and children and 2,000 are aged persons, leaving only about 2,000 able-bodied men, most of whom are re-servists. These are chiefly soldiers who were called home from the United States to participate in the war and have now been discharged. There are practically no immigrants from Germany, Austria or Russia and the great majority of those that do come are Jews from all countries.

Slowly Increasing Labor Balance

According to the records of the year ending June 30, compiled by Commissioner Wallis of the Ellis Island Immigration Bureau, the total number of arrivals and departures of aliens from this city during the year were respectively 314,468 and 334,254 showing a net loss of population of 19,786.

This loss, however, occurred entirely during the first part of the year, while the figures show that in the last months the ratio was in the opposite direction, with arrivals 29,098 in March and 47,715 in June and corresponding departures of 26,169 and 37,585, showing in the last month an excess of immigrants over emigrants of 10,130, a number which would have been considerably larger except that the departures had increased much more rapidly over those of the preceding month than had the arrivals. The favorable balance was greatest in May, when there were 40,048 arrivals and 21,162 departures showing a balance of 18,886 in our favor. This goes to show that America is still more attractive than Europe to laborers and that the depleted labor supply abroad is still able to furnish an increasing supply for us if legal and transportation difficulties permit.

Increased Arrivals of Immigrants

During the week ending July 10, 13,161 aliens were landed at Ellis Island, New York of whom 11,161 were steerage passengers and 2,000 were cabin passengers. A marked change in the character of immigrants is noted in the fact that, unlike the previous recent arrivals, the percentage of men was larger than that of women and children, notably so on the steamship Mexico which brought only 14 women and 552 ablebodied men and boys 16 years old and upwards. These all came from Portugal and were enroute to Massachusetts or California where there have been established large Portugese settlements.

In 1914, just before the beginning of the European war, the tide of immigration to this country reached the enormous total of 1,403,000 but since June 30 of that year there has never been a single week in which 13,161 aliens arrived.

Waiting List for Europe

It is officially stated that more than 2,500,000 foreign born citizens of this country are waiting an opportunity to return to Europe and would now be departing in very much larger numbers if there was available sufficient transportation.

This does not, however, mean that these laborers will remain abroad. The indications are that as soon as they discover the high cost of living and difficult conditions left over from the war, a large proportion of them will be glad to return to America in the hope of finding better jobs, higher pay and pleasanter conditions in this country.

More Alien Arrivals than Departures

Papers recently furnished by the department of labor, Bureau of Immigration show that during the months of July, August and September, 1919, 65,333 immigrants arrived in the United States and 82,461 aliens departed making a net loss of 17,128.

During the months of October, November and December, 1919 and January and February, 1920, the arrivals amounted to 159,014 and the departures amounted to 122,444 showing a net increase of 36,570.

The above are the latest figures furnished by the bureau but current reports from Ellis Island where about 80 per cent of the immigrants for this country arrive, indicate that the ratio of arrivals to departures is rapidly increasing, and that the total number of immigrants is much larger than it has been for many years previously.

Assisting Immigrants

The National Americanism Commission of the American Legion has made arrangements with the Immigration Commissioner for forwarding to the different posts of the legion, the names and destinations of all immigrants so that legion members, preferably those who speak the alien language, can welcome them and help them to become 100 per cent American.

Farmers Want Immigrants

According to Chas. M. Gardiner, an official of the National Grange, the general sentiment among U. S. Farmers is for the encouragement of immigrants to the points where they are most needed. They should not be permitted to join existing large foreign colonies, some of which promote sedition and anarchy, and they should not include radicals and those of bolshevist tendencies that make the process of Americanization more difficult.

Labor in Washington

Reports from the state of Washington, announce a slight reduction in the shortage of foreign laborers and a considerable shortage of unskilled labor help in the western part of the state, while in Seattle there has developed during the last month a slight excess of skilled and unskilled labor.

The representatives of 75 South Carolina cotton mills have voted to maintain the number of working hours per week at 55 as a vital necessity.

Indication Reported of Increasing Labor Efficiency

In reply to a questionnaire issued by the Industrial Bureau of the Merchants Association, New York, 49 manufacturers representing 14 industries, reported in September, 1919 that in general, labor was not more than 70 per cent efficient judged by normal standards. The present report of the same manufacturers indicates some increase in efficiency, especially during the last four or five months. In general, the increase cannot be measured but is considered to be now underway.

Of the 49 letters, 23 announced a noticeable increase of efficiency since last September, five merely allude to a better spirit among their employees, 17 have observed no change, and 3 report a decrease.

Among various reasons suggested for the improvement are increasing number of applicants for positions and the change from time-work to piece-work.

One manufacturer reported a six weeks shutdown due to unsatisfactory relations on account of the union, followed by a complete change which has secured an increase of between 30 and 40 per cent in production with a tendency to still greater increase.

Another manufacturer reports that since inagurating piece-work, the output is entirely satisfactory, but that the output on time labor is fully 30 per cent below normal.

Philadelphia Strike Becoming Violent

The strike of Philadelphia laborers for almost double wage, reduction of hours from 10 to 8 and closed-shop has forced the employers in organized action to declare that if the men did not return to work they would be locked out, that the closed-shop would not be tolerated and that common labor must work 10 hours daily in order to keep skilled labor at work during 8 hours. As a result, the Trade Council has declared a guerrilla warfare to harass the employers by calling the men off from one important job after another.

Work on a number of important buildings has been stopped or very much retarded, strikers have attacked loyal workmen with knives, clubs and stones and serious disorders and arrests have been frequent.

Owners are afraid to commence operations on account of high prices of labor and materials due to strikes and transportation difficulties and contractors are unwilling because they cannot be sure that the men will complete the work after commencing it. The blame for this condition is laid not on the workers but on organizers and agents who keep the men discontended and excited.

Tunnels Wanted in Colorado

In November, the state of Colorado will vote on the initiative and referendum petition, for which more than 16,000 signatures have been secured, to amend the state constitution and provide for the construction of three summit railroad tunnels to cost $18,550,000 to be owned by the state and provide for trains, automobiles and army trucks.

Pennsylvania Automobile Licenses

License No. 469,000 was issued by the Automobile Division of the Pennsylvania State Highway Department on July 9th, and the Department predicts that over 525,000 licenses for pneumatic tired vehicles will be issued this year. The total issued for such vehicles in 1919 was 441,-224. There has been an increase also in solid tired vehicles, the total on July 9th for the year having been 41,556, while the total for 1919 was 40,893. The total registrations of pneumatic tired vehicles for the six years from 1914 to 1919 inclusive, have been as follows: 104,950, 152,365, 218,846, 306,001, 363,001, 441,224.

A new New York State law restricts trucks and trailers operating outside of cities to a width of 8 feet, height of 12 feet 6 inches, and total weight of 25,000 pounds.

Coal Supply

In New York City, due principally it is claimed to tranportation difficulties, the danger of a coal famine appears to be growing larger rather than smaller. Notwithstanding that at this season of the year the consumption is a minimum and under normal coditions the reserve should be rapidly built up and stocks accumulated during the summer, the Public Service Commission reports that the combined stocks of all of the utilities in the city only aggregated 137,820 tons on July 12, showing a falling off of more than 50,000 tons from the previous week and leaving an extremely narrow margin of safety for regular operations.

Between the miners, the producers, the railroads, and the government as represented by the Interstate Commerce Commission, there is no difficulty in passing the blame for this situation back and forth from one to the other and as usual, the public and the individuals suffer.

Among those responsible, bad judgment and bad faith doubtless exist in several quarters and although part of the deficiency may be at present unavoidable, there is little doubt that the quantity is much samaller and the price much higher than there is any reasonable excuse for.

The violent disorganization of transportation that has resulted from the priority orders in favor of coal-cars does not cure the situation, in fact it does not efficiently relieve it; but it does work tremendous hardships and injustice to many other national interests, particularly to general construction. Until the profiteering of both labor and capital is under control and some very radical changes have been made and assistance provided to rehabilitate the transportation system that was wrecked and hamstrung by the government administration, we cannot hope for great or permanent improvement.

Recent Legal Decisions

DAMAGES FOR DELAY ON PUBLIC WORKS, WHERE LIQUIDATED

The Oregon Supreme Court holds, Star Land Co. v. City of Portland, 189 Pac. 217, that a provision in a contract with a municipality for the erection or construction of public works, such as street improvements, that for each day's delay in completing the improvement the contractor should as liquidated damages pay to the municipality $10 is valid and enforceable where the amount of damage would be practically incapable of computation, and therefore the provision could not be treated as a penalty.

CONTRACTOR ENTITLED TO RECOVER PRO RATA FOR ROAD WORK DONE BEFORE DEFAULT—CONTRACTOR HELD LIABLE FOR COST, NOT REASONABLE VALUE, OF COMPLETION BY ANOTHER

A contract was made with a county to make a dirt fill for the construction of a highway at 70 cents per cubic yard. The contract provided that in case the contractor failed to complete the work the county might complete at the contractor's expense. The total amount to be moved under the contract was 14,000 cubic yards. After the contractor had removed about 2,000 cubic yards, proper notice was given, the work was taken over and the contract relet at 92 cents a cubic yard. The county sued the contractor and his surety for the difference between the contract price and the reletting price, 22 cents per cubic yard. The contractor counterclaimed for the contract price at 70 cents per yard for moving 2,170 cubic yards. It was held, Bayfield County v. Agren, Wisconsin Supreme Court, 177, N. W. 591, that the contractor was entitled to recover on this counterclaim, such a contract being divisible, and not entire, as claimed by the county.

The question of cost of completion has apparently never been before the Wisconsin Supreme Court before. The trial court held that the burden was upon the county to show what the reasonable price of completing the contract was. The Supreme Court, however, thinks that the rule adopted by some courts, that when a contract provides that in the event of a breach of the contract by the contractor the owner may take possession and complete the same at the contractor's expense, and that the amount of recovery is limited to the reasonable cost of doing the work without reference to the actual expense thereof, works an injustice to the owner. "It is a matter of common knowledge," the court says, "that it is oftentimes difficult to procure labor to complete a half-finished job. Seasonal obstacles oftentimes present themselves. Difficulty in procuring material and competent workmen often renders the completion of the task more expensive than the doing of the same amount of work would have been under a continuous operation. . . . It is much more just and reasonable, under a contract authorizing the owner to complete the work at the expense of the contractor, to permit the owner to receive the actual cost of completing the contract, where the owner has acted diligently and in good faith, and there is no evidence of fraud or negligence. . . . An owner may not, of course, under such circumstances, proceed to make the completion of the work as expensive as possible, but where he does proceed in good faith and with diligence to have the work completed, he ought not to be subjected to the hazards of litigation to ascertain the amount due him from the contractor. The employment of experts in cases of this kind is not always a satisfactory substitute for actual experience, and the opinion of experts ought not to be admissible where there is no evidence of negligence or fraud. Zimmerman v. Jowigensen, 14 N. Y. Supp. 548 affirmed 144 N. Y. 656." Judgment for defendants was therefore reversed.

STATUTORY LIEN FOR CONSTRUCTING IMPROVEMENTS AGAINST SCHOOL CORPORATION PROPERTY

In an action by a contractor against an Indiana school township to foreclose a lien on the defendant's real estate for the cost of constructing a sidewalk abutting thereon, the Indiana Appellate Court holds, Cain School Tp. v. Synder, 106 N. E. 686 that the contractor was entitled to a lien under the Indiana act passed in 1903 to the effect that all common school corporations of the state shall be subject to the same duties and liabilities in respect to municipal assessments for the cost of public improvements affecting their real estate as private owners of real estate, and that their real estate shall be subject to liens on account of public improvements the same as if it had been owned by a private citizen, excepting only as to penalties and attorney's fees. The contractor has the right to have his lien judicially declared and established and the extent and amount thereof judicially determined.

ACCEPTANCE BY TELEGRAM MAKES COMPLETE CONTRACT—SUGGESTION OF MODIFICATION

A corporation engaged in the construction of buildings contracted for the erection of a courthouse and jail, and to furnish certain material therefor manufactured by another corporation. In an action by the latter against the construction contractor, it was held, E. T. Barnum Iron Works v. Prescott Const. Co., 102 S E. 860, that the question whether a series of letters and telegrams passing between the parties constituted a contract was for the court, not the jury, to determine. Where an offer expressly or impliedly requires or authorizes acceptance by wire, the sending of an unequivocal telegram of acceptance by the offeree to the person making the offer constitutes the transaction a completed contract. If an offer is accepted as made, the acceptance is not rendered ambiguous or conditional by uniting with it an expression of hope or suggesting that some unimportant addition or modification be made in its terms.

NEWS OF THE SOCIETIES

August 14-18—ENGINEERING INSTITUTE OF CANADA, CALGARY BRANCH. Meeting at Banff. F. C. Emery, secretary. Western professional meeting, Calgary, Canada.

Aug. 26-Sept. 3—AMERICAN PUBLIC HEALTH ASSOCIATION. San Francisco. Office of Secretary.

Sept. 7-16—NEW ENGLAND WATER WORKS ASSOCIATION. Annual convention, Holyoke, Mass., Secretary, Frank J. Gifford, 715 Tremont Temple, Boston, Mass.

Sept. 13-17—AMERICAN PUBLIC HEALTH ASSOCIATION. Annual convention San Francisco, Cal.

Sept. 13-17 — SOUTHWESTERN WATER WORKS ASSOCIATION. Annual convention, St. Charles Hotel, New Orleans, La. Secretary, E. L. Fulkerson, Waco, Texas.

Jan. 25-27, 1921—THE AMERICAN WOOD PRESERVERS ASSOCIATION Annual convention. Place to be announced.

COMMITTEE OF EDUCATION FOR HIGHWAY ENGINEERING AND HIGHWAY TRANSPORT ENGINGEERING

This committee just established by the Department of the Interior of the United States, has been formed to study the relationship existing between the highway roadbed and the motive unit. It will also study various problems of highway development and make recommendations for more efficient administration of highway construction.

The committee, headed by T. H. MacDonald, chief of the U. S. Bureau of Roads and Col. Mason M. Patrick, Corps of Engineers, U. S. Army, has distinguished men representing the tire and rubber industry, the automotive industry, the American Association of State Highway Officials, engineering schools, and the U S. Bureau of Education.

U. S. FOREST PRODUCTS LABORATORY CELEBRATION

The Forest Products Laboratory of the United States Department of Agriculture and Forest Service held a decennial celebration at Madison Wisconsin, July 22-23. Headquarters were established at Park Hotel, Capital Square, and the general assembly met in the Agricultural Hall, University of Wisconsin, H. F. Weiss, chairman.

Important subjects among the papers and discussions included, "Legislative Measures for Forest Conservation," The Honorable Emanuel L. Philip, Governor of Wisconsin; "Translating Knowledge Into Power," E. A. Birge, L. L. D., S. C. D., President of the University of Wisconsin; "The Forest Products Laboratory, C. P. Winslow, Director, Forest Products Laboratory; "What Research Has Accomplished for the Automotive Industry" C. F. Kettering, Chief Engineer, General Motors Company; "Forest and National Prosperity," Lieutenant-Colonel W. B. Greeley, Forester, Forest Service, U. S. Dept. of Agriculture; "Some Problems of the Pulp and Paper Industry" D C. Everest, Secretary and General Manager, Marathon Paper Mills Company; "America's Place in Industrial Research" H. E. Howe, chairman, Research Extension Division, National Research Council; "Some Problems of the Lumber Industry," F. J. Scanlon, Member of the Forestry Committee, National Lumber Manufacturers' Association.,

A Wood-Using Industries Conference on a National Forestry Policy was held on July 23 at 2:00 P. M. in Argicultural Hall, University of Wisconsin.

A meeting of the Executive Committee of the American Wood Preservers' Association was held on the afternoon of July 22.

Deans of Forestry and Engineering Schools met July 24 to consider a curriculum for Forest Engineers.

There was a meeting of the Interregional Technical Committee of the National Lumber Manufacturers' Association on the morning of July 24.

The Venetian Night Regatta of the University of Wisconsin was held at the foot of Park Street on Lake Mendota on the afternoon and evenings of July 23.

MISSOURI GOOD ROADS FEDERATION

On July 12, a meeting of thirty-five members of the Missouri Good Roads Federation representing the executives and finance committees and the standing committees was held at the office of the Federated Roads Council, St. Louis, and adapted a plan for raising a $100,000 compaign fund to promote the $60,000,000 bond issue for road improvement in Missouri to be voted on in November.

For this purpose, St. Louis will raise $75,000 and Kansas City will raise $50,000; part of the money to be turned over to the state organization and part of it to be used for promotion of city activities. The program includes vigorous advertising and a truck tour through the state.

A general convention of the Missouri Good Roads Federation, including county organizations with a roster of more than 15,000 names, will be held in St. Louis in the latter part of August.

AMERICAN MILITARY ENGINEERS

The Buffalo Chapter of the Society of American Military Engineers has been organized and elected Col. Clarke S. Smith, pres., and Captain A. B. Jones, secretary and treasurer.

AMERICAN ASSOCIATION OF ENGINEERS

At the July 15th meeting of the Indianapolis Chapter, the principal subjects considered were the practice of free engineering service by governmental or educational institutions and manufacturing firms, the work of the railway wage boards now sitting at Chicago, the improvements of the local street railway service, and the plans designed by the architects' association for an Indianapolis civic center.

PERSONALS

Springer, E. R., has been appointed chief engineer of the Boston Transit Department.

Davis, E. S., chief engineer of the Boston Transit Dept., has resigned after many years of service for the city.

Donnelly, C. E., has been appointed office engineer for the city planning commission, Kansas City Mo.

Baron, E. V., is in charge of the Priest Rapids Irrigation District, with headquarters at White Bluffs, Wash.

Green, H. P., has been made president of the Herbert Post Green and Associate Inc., archieects, engineers and cost engineers, New York City.

Mooney, B. E., has been appointed city engineer and water commissioner of Whitefish, Mont.

Leighton, M. O., has been organized an engineering firm in Washington, D. C.

Beattie, G. T., is highway engineer for the U. S. Bureau of Public Works at Missoula, Mont.

Lingley, Ralph G., has been elected superintendent of sewers of Worcester, Mass.

Moore, H. J., has been appointed forester of Provincial Highways for Canada, and will have charge of beautifying the roadways by planting shade trees and shrubs.

Blunt, G. A., has been appointed engineer of Dubuque County, Ia.

Mackall, J. N., has been appointed chairman and chief engineer of the State Roads Commission of Maryland.

Dunn, H. L., has been appointed superintendent of street construction, Columbus, Georgia.

Bramhall, I. N., a contractor in Tekamah, Nebr., was killed by a train June 1.

Parmer, Claude, vice-president of the Kuest Contracting Company, Indianapolis, was recently killed by a bridge erection accident at Cincinnati.

Butler, Wm. P., senior highway engineer of the U. S. Bureau of Public Works, and has resigned from that position and has become consulting engineer of the Southern Surety Company in charge of their highway interests.

Earle, D. M., has been appointed city engineer of Worcester, Mass.

Boggs, J. S., has been appointed state highway engineer of Kentucky.

Taylor, P. T., has been made city manager of Grand Haven, Mich.

Kulicka, O. C. and A. E. Boyte have established the Delta Engineering Co., at Greenville, Miss.

McKee, Alfred, has been appointed engineer in charge of bridge construction for Polk County, Ia.

Moultrop, I. E., has been elected by the United Engineering Society as a trustee of the American Society of Mechanical Engineers and a member of Engineering Foundation Board.

Deeds, J. F., of the U. S. Geological Survey, is investigating the irrigation projects along the Musselshell River, Mont.

Scott, T. S., is in charge of road construction work in Brockville, Ont.

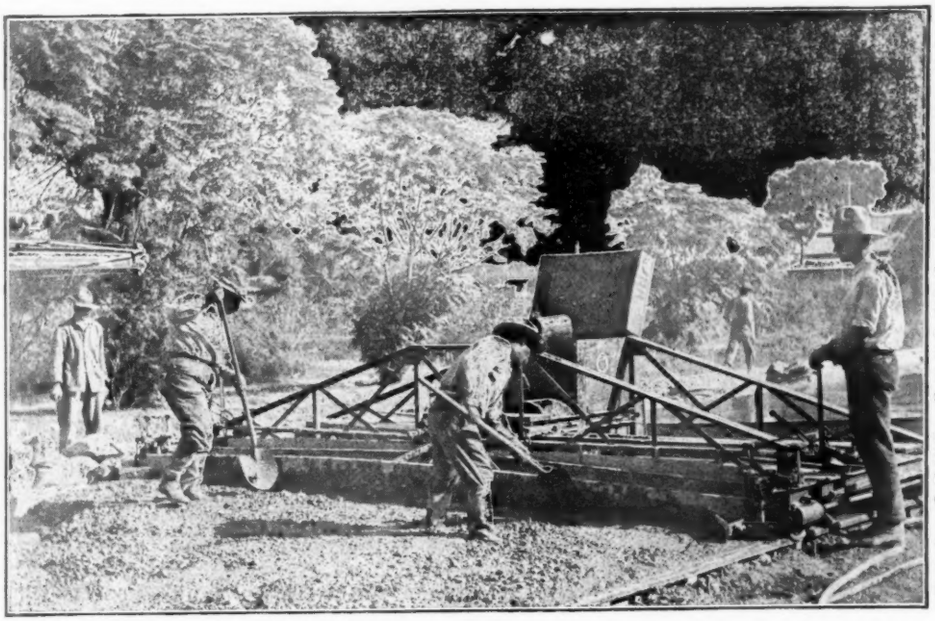
New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Instal'ations

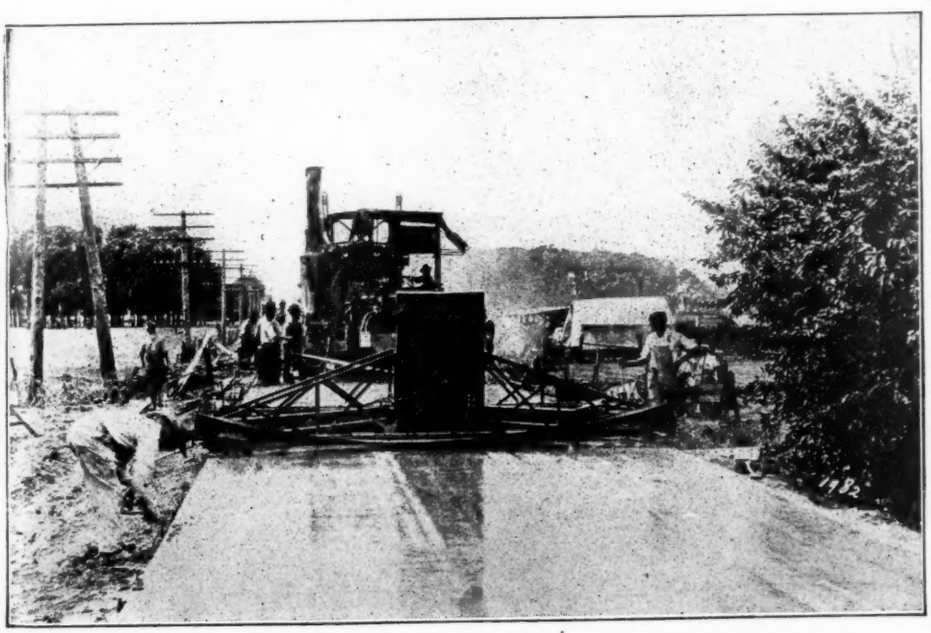
LAKEWOOD ROAD FINISHING MACHINE

A machine for eliminating hand work in finishing concrete roads and pavements has been put on the market by the Lakewood Engineering Company. This installation permits the use of drier, coarser mixtures, removes air and water from the concrete and enables a coarser aggregate to be used than is practicable with hand work.

The machine spreads the concrete as it comes to the mixer to approximately the desired height and crown; tamps and compacts the concrete to the finished height and crown; and floats the surface of the concrete smooth with a belt. In this way the machine enables the work to be done more rapidly and with a smaller force than by hand.



FINISHING MACHINE DRESSING CONCRETE TO APPROXIMATE HEIGHT AND CROWN WITH STRIKE-OFF



SMOOTHING SURFACE OF CEMENT PAVEMENT WITH BELT ATTACHMENT OF FINISHING MACHINE

As the machine travels back and forth under its own power, a screed-like element, called the strike-off, spreads the concrete to the approximate height and surface, after which the tamper, located just back of the strike-off, tamps the concrete, the first time over with long hard stroke, the second time with a short rapid stroke, continually agitating the concrete as regulated by the operator.

At the rear of the machine, a finishing belt moves slowly across the surface of the concrete to give it a smooth finish, which however, is sometimes omitted in favor of the finish produced by rapid strokes of the tamper that gave a slightly roughened surface and a perfectly true crown.

The reduced amount of water and the thorough tamping produce a concrete that is stronger than the handfinish pavement and permit the use of concrete so dry that it can be satisfactorily hauled a considerable distance from a central mixing plant without separation of the aggregate.

The machine can be operated by one man on either side of the road and if he has two helpers with spades, the work can be done better than is ordinarily done by eight or nine men.

The machine was successfully used on about 200 road jobs in the year 1919.

PURE WATER FOR SWIMMING POOLS

This pamphlet describes the importance of puriffying water in swimming pools and the manner in which it can be reliably and economically performed by use of the Wallace & Tiernan Companys' chlorine control apparatus. The state laws of Florida and of California require a high standard of purity to be maintained for the water of swimming pools which can be secured either by waste and refilling, or by circulation and purification.

If a 50,000-gallon pool be refilled once a week with water costing 5c per 100 gal. the annual cost will probably exceed $1,250. Better results for the same pool are claimed by the use of the chlorine purification process at a daily cost of only 6c for chlorine and a total cost including the interest on the investment, of not more than 30c per day. It is claimed that the same water after being used 6 months with daily purification is often purer than when first admitted to the pool.

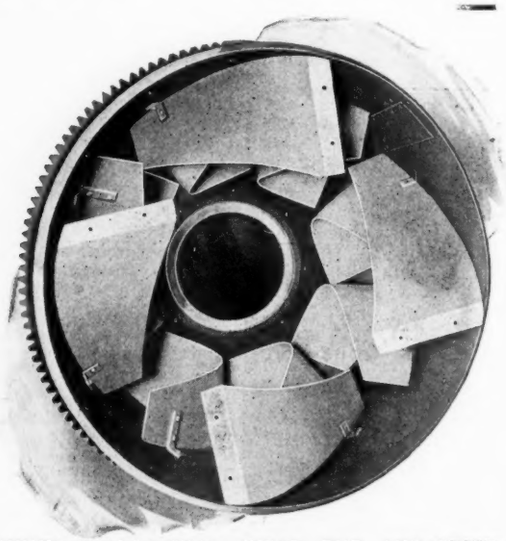
The chlorine is sold in liquid form in 10 to 150 pound cylinders and, when released, volatilizes and passing through a pressure compensator is introduced into a solution jar where it is throughly mixed with water and discharged by gravity into the pool. When this method is used, additional water supply is only necessary to compensate for evaporation and waste.

RANSOME STANDARD MIXERS

The Ransome standard mixers, 1920 model, represent the combination of successive developments for 70 years in the uninterrupted succession from the first Ransome and his son, E. L. Ransome, "The father of the concrete mixer industry," to the present Ransome Concrete Machinery Company, which designs and manufactures all kinds of plant and equipment for concrete construction.

The new hoist drum is of a conical shape with a spiral groove, increasing the life of the hoist rope and providing for an acceleration of hoist speed as the load becomes lighter.

The batch hopper is provided with a vertical sliding gate mounted entirely on the outside of the hopper with the guides so arranged that there is no point at which concrete can lodge and interfere with the operation of the gate.



MIXING BLADES THAT KNEAD, RUB, AND GRIND THE AGGREGATE

The standard mixers are heavy, and are claimed to be durable and efficient. Their capacities are rated for a wet mixed product made with stone not larger than 1½ inch diameter and 1¼ gallon of water per cubic foot of concrete. The mixer is materially modified in the present 1920 design, commenced in 1918 and thoroughly tested to prove every new detail and insure abundant strength. The truck and frames are very substantial and all of the principal bearings are equipped with Hyatt rollers mounted in ball and socket hangers that insure absolute alignment and eliminate a large amount of friction

The old cast-iron drums are replaced by steel, equipped with extra-heavy steel mixing blades which operate on the principle of grinding, rubbing, contact and forcible kneading of the materials into a homogeneous body—concrete." The special shape and arrangement of the mixer blades enable the machine to handle dry mix which is even more difficult than wet mix.

The drums are provided with high-carbon steel tires forged by drop hammers from a solid billet, rolled, turned and shrunk on, thus giving an efficiency equal to that of locomtive tires and insuring against the flat wearing of other kinds of tracks.

In order to insure the rapid discharge of the dry mixture, the number of blades in the drum has been doubled. The discharge mechanism has been completely redesigned ,and is now modified by the addition of a splash plate to prevent any slopping.

INDUSTRIAL NOTES

THE INDUSTRIAL CITY OF BLAW-KNOX

About 1,000 persons are employed in the Blaw-Knox shops, most of whom live in Old Hoboken. A petition signed by the people of the town, asking the U. S. Senate to change the postoffice name to Blawnox, has just been granted.

"Blawnox" is the home of Blaw-Knox Co., manufacturers of Blaw Buckets, Blawforms concrete Construction, Knox Water-Cooled Doors and Ports, Prudentian Steel Buildings Transmission Towers, and other structural and plate steel products.

The Blaw-Knox Company first established in Hoboken about five years ago, occupying a comparatively small shop, at the same time operating another plant at Wheatland, Pa. About two years ago the latter plant was removed and added to the Hoboken works. The magnitude of the works has since increased by the erection of a large hammer-welding plant, augmenting the already extensive oxy-aceylene and electric welding facilities of Blaw-Knox Company.

AMERICAN-LA FRANCE FIRE ENGINE COMPANY INCORPORATED

The American-LaFrance Fire Engine Company, Inc., reports June sales of 27 important items of pumping engines, hose carts, combination cars, service trucks and tractors and June shipments of 35 items of similar nature. These have gone to 18 different states and to Canada and Japan.

IOWA ROAD BUILDING COMPANY FORMED

The Iowa Willite Construction Company has been organized by a number of Davenport citizens, with Alfred C. Mueller as president and William Howe as general manager. It is the plan of the company to place some stock in each county of the State. The company will specialize in the construction of pavements and roads, especially that type of road known as "Willite."

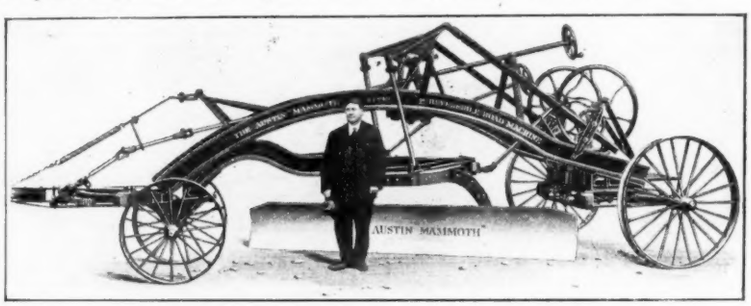
The Keystone Sheet Metal Works, 139 Broome Street, Newark, N. J., have been organized to manufacture sheet metal products. Samuel Kibbel heads the company.

MAMMOTH GRADERS SOLD WHOLESALE

On account of the scarcity and high cost of materials and the difficulty and uncertainty of transportation, the state of Nebraska has modified its highway construction problem and is temporarily devoting a larger part of the new construction to the building of earth roads of a character that can later be transformed into hard surface roads when conditions are more favorable.

To supplement the scarcity of men and plant, the state has purchased for use this season, a consignment of 70 Austin-Western Road Machinery Company's Mammouth graders weighing 6,350 pounds each and having blades 12 feet long. The graders are accompanied by heavy tractors that are available for any kind of hauling when not in service with the graders.

This equipment equals an army of laborers with hundreds of teams and is doing the work more rapidly, satisfactorily and economically than it could be accomplished by hand, while the use of a single type of machine avoids complication, makes both machines and operators interchangeable, reduces first cost and maintenance and establishes a desirable standard.



MAMMOTH ROAD GRADER MACHINE TO BE HANDLED BY TRACTOR